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# Soviet Civil Defense: Objectives, Pace, and Effectiveness

Interagency Intelligence Memorandum

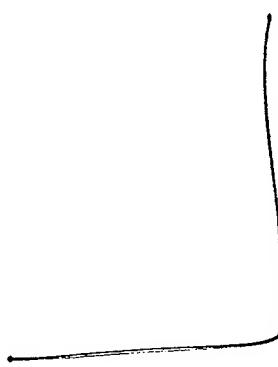
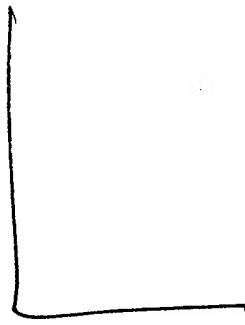
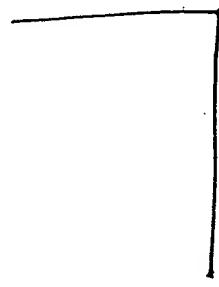
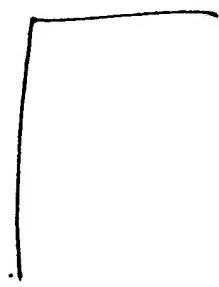
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SOVIET CIVIL DEFENSE:  
OBJECTIVES, PACE, AND EFFECTIVENESS

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## KEY FINDINGS

Soviet civil defense is an ongoing, nationwide program under military control. It is focused primarily on protection of people—the leadership, essential personnel, and the general population, in that order—continuity of economic activity in wartime, and recovery from the effects of a US nuclear attack. While it is not a crash effort, the pace of the program, as indicated most clearly by shelter construction starts in urban areas, increased beginning in the late 1960s, and improvements have been made in virtually all facets of the program. However, the program has been marked by wide variations from area to area and year to year in both the rate of shelter construction and the total number of shelters and by bureaucratic difficulties and apathy toward civil defense by a large segment of the population. Most progress has been made in providing shelters for the leadership and essential personnel; shelters are available for at least 10 to 20 percent of the urban population, which, however, must depend mainly on evacuation for protection. The Soviets have made little progress in protecting industry by hardening and geographic dispersal.

While total civil defense costs are unknown, cost estimates have been made of three major elements of the Soviet program: about 117,000 full-time civil defense personnel, operation of specialized military civil defense units, and shelter construction. The cost of these elements in 1976 amounted to about 400 million rubles, less than 1 percent of the estimated Soviet defense budget. If these three elements of the Soviet program were to be duplicated in the United States, they would cost about \$2 billion in 1976, with about three-fourths of this representing manpower costs. (These estimates should be considered rough approximations because they are affected by uncertainties both in the quantitative data on civil defense programs and in estimates of prices.)

Programs for protection of the leadership appear to be well advanced. We estimate that the Soviets have sufficient command post shelter space for virtually all of the leadership elements at all levels (about 110,000 people). Counting all shelters, including those found at economic installations and in residential areas, we estimate that a minimum of 10 to 20 percent of the total population in urban areas could presently be sheltered. This figure would rise to 15 to 30 percent by 1985, assuming no change in the present rate of shelter construction and taking into account expected population growth in urban areas.

Despite the scope and pace of shelter construction, large-scale evacuation away from target areas remains the key to a marked reduction in the number of casualties. We estimate that an evacuation of the bulk of population from urban areas could be accomplished in two to three days, with as much as a week required for full evacuation of the largest cities. These times could be extended by shortages in transportation, other bottlenecks, or adverse weather conditions.

In analyzing the effects of civil defense on levels of damage and casualties the Soviets might sustain, we used a hypothetical attack by 1977 US forces against high-value military and economic targets,

[ ] In the attack, [ ] about 2,200 weapons were optimized against critical Soviet economic targets. These weapons were in addition to those used against military targets and those held in reserve. We assumed a single retaliatory attack by US forces immediately following a Soviet first strike. Our analysis in effect tends to present a "worst case" for the United States, especially if Soviet population casualties are a major criterion. Moreover, we have estimated only those casualties during the first month following an attack resulting from prompt nuclear effects and early fallout.

On the basis of our analysis, we estimate that Soviet measures to protect the economy could not prevent massive industrial damage. The hypothetical US attack destroyed 80 percent of the economic value of critical industrial installations in the selected target list. The specific damage levels shown by our analysis are subject to some uncertainty owing to the structural damage criteria we used for assessing economic loss. The Soviet program for dispersal of industry appears to be offset by a contrary tendency for investments in new facilities to be inside or near previously existing installations. The Soviet measures for protecting the work force, critical equipment, and supplies, and for limiting damage from secondary effects could contribute to maintaining and restoring production after an attack. We have not, however, analyzed the Soviet potential for recovery. We expect some improvements in the level of protection for the economy, but any radical change in its vulnerability to nuclear attack is unlikely.

The effectiveness of civil defense in reducing casualties in the USSR and in coping with the postattack period would depend primarily on the time available to make final preparations prior to an attack. Using the results of the hypothetical attack referred to above, we estimate that:

- Under the most favorable assumptions, including sufficient time to complete urban evacuation and to protect the evacuated population, Soviet civil defenses would reduce casualties to about 20 million, and would assure survival of a large percentage of the leadership element. With only a few days' preparation, casualties would be about 50 million.

- Under worst conditions, with only a few hours or less to make final preparations, prompt casualties would exceed 120 million.
- The critical time for preparation appears to be about two or three days, because only by evacuating could the Soviets hope to avert massive losses.
- While a large percentage of essential personnel sheltered at economic facilities would probably survive a US attack, the Soviets could not prevent massive damage to their economy and the destruction of many of their most valued material accomplishments.

The casualty levels noted above could be increased if the United States attacked while an evacuation was in progress, increased the number of targets, stretched out the attack over a longer period, structured the attack to produce more fallout, or if an evacuation was less expeditious than planned or was impeded by adverse weather or transportation deficiencies. In assessing the protection afforded by their civil defenses, the Soviets would take account of these uncertainties.

The Soviets almost certainly believe their present civil defenses would improve their ability to conduct military operations and would enhance the USSR's chances for survival following a nuclear exchange. They cannot have confidence, however, in the degree of protection their civil defenses would afford them, given the many uncertainties attendant to a nuclear exchange. We therefore do not believe that the Soviets' present civil defenses would embolden them deliberately to expose the USSR to a higher risk of nuclear attack.

We have no present reason to believe that in the foreseeable future there will be any significant change in the Soviet leaders' judgment that civil defense contributes to war-fighting and war-survival capabilities, nor do we believe that their uncertainties about its actual effectiveness would be lessened. Thus, we have no present reason to believe that their perception of the contribution of civil defense to their capabilities for strategic nuclear conflict will change significantly.

## SUMMARY AND CONCLUSIONS

1. This study of the Soviet civil defense program focuses on those factors most likely to affect perceptions of the strategic balance between the Soviet Union and the United States: the Soviets' ability to assure the survival of their leadership, their ability to protect centers of production, and their ability to protect population. Because we do not know much about the consequences of a large-scale attack on the functioning of a modern, industrialized society, the study deals with that relatively brief period following a strike during which the most obvious effects of a nuclear exchange would be apparent. It does not assess the Soviets' post-nuclear-attack capabilities to conduct military operations or their longer term prospects for political cohesion and reconstitution of the economy.

2. We have attempted to describe the Soviet program in a way that would allow for an assessment of the confidence that the Soviet leaders place in the program—the degree to which their civil defense makes them feel more able to withstand the consequences of a strategic nuclear exchange. Consequently, we have examined all-source intelligence describing the civil defense organization, priorities, training, and propaganda efforts from which inferences might be drawn. A principal effort has been to analyze what the effect of a US attack on the Soviet Union would be—to assess the degree of protection provided for the leadership, for the economy, and for the population.

### Organization, Priorities, and Pace

3. The Soviets' strategic writings integrate civil defense into their military strategy. It is part of a general scheme of the likely origins, course, and consequences of nuclear war. Aside from these considerations, the Soviets' experiences in World War II, together with their traditional concern for homeland defense, reinforce their interest in civil defense. By developing an active and extensive civil defense program, in conjunction with their other defensive and offensive strategic programs, they hope to convince any potential enemy that it cannot win a war with the USSR. But if war should occur, the Soviets seek, through civil defense and other means, to assure the survival of the USSR and to be in a stronger postwar position than their adversaries. Civil defense is meant to contribute to the maintenance of a functioning

logistical base of operations by regular armed forces to win the war, to limit human and material losses, and to enable the Soviets to speed recovery from the consequences of war.

4. The Soviet leaders' emphasis on civil defense offers the potential to foster favorable popular attitudes toward the Soviet system, to demonstrate leadership concern for the people, and to lend credibility to calls for vigilance against potential enemies. Nearly every Soviet citizen receives civil defense instruction either in school, or through training courses, lectures, and exercises at places of work. Public attitudes about surviving a nuclear war remain skeptical, however, and there is evidence that many people do not take the program seriously. Nevertheless, we believe, on the basis of human source reports and US and Soviet studies of public disaster behavior, that the Soviet people would respond to directions from civil defense authorities.

5. A publicly recognized, highly structured, military-controlled civil defense organization exists at all levels of the Soviet government and economy, with the head of every organization designated "chief of civil defense." The national organization is led by General of the Army A. T. Altunin, a Deputy Minister of Defense. Full-time civil defense staffs exist at each echelon of the Soviet administrative structure: national, republic, oblast, city, and rayon, as well as at all significant economic institutions and enterprises.

6. In wartime, this administrative structure would be converted into a civil defense chain of command subordinate to the deputy commander for civil defense of each military district. The operating elements of the Soviet civil defense program—those that would carry out postattack recovery—consist of a large number of military civil defense units, communications elements, and civilian civil defense formations. Counting all civilian units and formations according to guidelines issued by General Altunin in 1975, the total number of people in the program would be upwards of 16 million—a number which includes many perfunctory participants. There are also about 117,000 full-time civilian and military personnel.<sup>1</sup>

7. The peacetime effectiveness of the civil defense organization suffers at times from the reluctance of industrial officials to spare labor and other resources for civil defense and from misunderstandings between civil defense officers and Soviet civilians. In wartime, increased centralization of authority would probably reduce many of the bureaucratic inefficiencies inherent in this large organization. But the fact that the organization exists, despite its problems, and the fact

<sup>1</sup> Last year's estimate of a minimum of 50,000 did not include full-time civil defense personnel at economic installations.

that progress is being made toward fulfillment of the objectives of the civil defense program give Soviet civil defense leaders some confidence in their ability to function as required. On the whole, the Soviets' view of their civil defense organization structure probably is a favorable one—overall, better than it was before the military assumed control of it in the early 1970s.

8. In terms of actual priorities the Soviet program appears to hew closely to what its organizers have declared their intentions to be. (See figure S-1.) The first priority is to protect people—the leadership first, other essential personnel second, and the rest of the population third. In support of this, they have built shelters, established relocation sites, and developed evacuation plans. The second priority is to maintain the continuity of economic activity in wartime. Much of the action on this program appears to have been directed toward providing protection for the work force. The third priority, "liquidation of the consequences of an enemy attack," involves the training of a broad spectrum of the Soviet population in postattack operations such as administering first aid, clearing rubble, decontaminating, and emergency repair and restoration of power.

9. The pace of the Soviet civil defense program is affected on the one hand by commitments of the leadership to realize progress in peacetime preparations, and on the other by reluctance of some

Figure S-1

Objectives and Priorities of  
Soviet Civil Defense

Program Objectives	Priority Tasks
Protection Of Human Resources	Sheltering and relocation of the leadership Sheltering and dispersal of essential workers Sheltering and evacuation of the urban population Stockpiling food and medical supplies
Continuity of Economic Activity in Wartime	Integration of civil defense and economic mobilization plans Rapid shutdown of industrial facilities Permanent and hasty hardening of installations and equipment Crisis relocation of economic enterprises Stockpiling reserves of materials Geographic dispersal of industry
"Liquidation of Consequences of Enemy Attack"	Preparation of military and civil defense formations Training in rescue and recovery Preparations for distribution of food and essential supplies

ministries, industrial managers, and local officials to dedicate scarce resources to what they regard as a secondary requirement and by apathy toward civil defense among a large segment of the public. While it is not a crash effort, the pace of the program, as indicated most clearly by shelter construction starts in urban areas, increased in the late 1960s. Civil defense preparations are continuing, but the extent of implementation of civil defense measures varies from area to area and year to year.

10. We are still unable to estimate the total annual costs of Soviet civil defense, but we have made a tentative estimate of the costs of three elements of the program: full-time civil defense personnel, now estimated to be about 117,000 people; operation of military civil defense units; and shelter construction. (See table S-1.) These three elements cost 400 million rubles in 1976. This figure, which indicates the burden of these three elements on the Soviet economy, represents less than 1 percent of our estimate of Soviet defense spending. If these three elements were duplicated in the United States, the costs would have been about \$2 billion in 1976. This figure conveys the magnitude of the program in familiar terms; it does not reflect the economic burden to the Soviets. The high dollar estimate results primarily from the relative costs of manpower in the United States and the USSR. Manpower represents about 70 percent of the total dollar costs—that is, about \$1.4 billion of the \$2 billion—but only about 40 percent of the ruble costs. (These estimates should be considered rough approximations

Table S-1  
Costs of Soviet Civil Defense  
Manpower, Operation of Military Units, and Shelter  
Construction\*

	Ruble Costs at 1970 Prices (Billions)		
	Before 1968	Total 1968-76	1976
Manpower.....	—	1.51	0.17
Operation of military units .....	—	0.35	0.04
Shelter construction .....	1.16	1.70	0.19
Total .....	1.16	3.56	0.40

	Dollars Costs at 1976 Prices (Billions)		
	Before 1968	Total 1968-76	1976
Manpower.....	—	12.20	1.39
Operation of military units .....	—	0.83	0.09
Shelter construction .....	2.80	4.20	0.47
Total .....	2.80	17.23	1.95

\* These estimates should be considered rough approximations because they are affected by uncertainties both in the quantitative data on civil defense programs and in estimates of prices.

because they are affected by uncertainties both in the quantitative data on civil defense programs and in estimates of prices.)

**Protection of the Leadership**

11. In case of nuclear war, the top national military and civilian leadership of the Soviet Union would be sheltered in hardened command posts near Moscow and at other sites independently of the civil defense program we describe in this paper. When we speak of measures for the protection of the leadership, we refer not only to the top national leadership, but also to some 5,000 party and government officials at the national and republic level; 63,000 party and government leaders at kray, oblast, city, and urban rayon level; 2,000 managers of key installations; and about 40,000 members of civil defense staffs—about 110,000 people in all.

12. Throughout the Soviet Union there is a pattern of shelter construction for the leadership. It consists of hardened underground shelters near their places of work and relocation sites some 20 to 40 kilometers outside the cities. These shelters are usually provided with communications equipment and are located near or on transportation routes. The local shelter and relocation site pattern extends from government ministries to party headquarters and oblast and city governments and includes sites for major industrial enterprises as well.

13. The resistance of these facilities to blast varies, depending on their location and prospective occupants. At some of the relocation sites for the top leadership, the hardness [ ]

[ ] figures are comparable to those for military command and control bunkers. The range of hardness for shelters for other national leaders is [ ]

[ ] Judging from analysis of Soviet designs, the remaining leadership shelters are estimated to be of about the same hardness as average shelters in industrial and urban areas. While we do not know much about exact amounts, we believe that in general these shelters have some stockpiles of food, medicine, protective equipment, communications, and other supplies for their prospective occupants.

14. We have surveyed only a small portion of all the cities and rural areas where leadership shelters would likely be found. The total floorspace for the leadership shelters we have identified and measured adds up to 206,000 square meters; roughly an equal number of shelters have been identified but not measured. We estimate, therefore, that, the Soviets have sufficient command post shelter space for virtually all

the leadership elements as defined in this paper. This estimate takes into account space required for supplies, communications, and work area.

#### Protection of the Economy

15. Plans for protecting the Soviet economy include a number of complementary measures, not all of which are to be taken at any individual site but which could apply selectively depending on a site's importance to a wartime economy. These measures include:

- Sheltering personnel at installations in the event of attack.
- Dispersal of a portion of the work force during a period of crisis.
- Emergency relocation of certain installations.
- Geographic dispersal of new installations.
- Hardening of physical structures.
- Hasty hardening measures when an attack is imminent, such as sandbagging of equipment and earth mounding around structures.
- Rapid shutdown of equipment.

16. To study the actual measures the Soviets have taken, we surveyed some 150 economic facilities distributed among 17 key industrial categories which we believe to be important for Soviet recovery from a nuclear attack. The primary civil defense preparations we were able to identify at the sample installations are those related to sheltering personnel. We found that shelters had been built or were under construction at the time of the survey at some 65 percent of the plants. More than two-thirds of the shelters identified have been built since 1968. Although shelter construction is continuing, construction starts observed at the facilities surveyed were highest in 1973. [ ] [ ]

17. We also performed various statistical tests on the sample to extrapolate our findings to the rest of Soviet economic facilities within these categories. For this purpose we used 10 of the 17 industrial categories on which our information was most complete. Assuming that our sample is roughly representative of Soviet industry as a whole and recognizing that our confidence bounds are large owing to our small sample and the variability of the data, some conclusions can be drawn:

- The increased level of shelter construction since 1968 indicates implementation of a Soviet plan. The rate of increase in construction was not uniform throughout industry, but was concentrated among large enterprises (those whose output falls in the upper 25 percent of production for a given category of

industry), at new installations, and at those undergoing expansion.

- Extrapolating from our sample, we calculate that the Soviets could shelter 12 to 24 percent of the estimated total labor force in these key industrial categories. This assumes a shelter occupancy factor of 0.5 and 1 square meter per person.<sup>2</sup> However, Soviet plans do not call for sheltering the entire labor force. They plan to close nonessential industries entirely and to evacuate nonessential workers from those industries that are to continue production. The remaining essential work force at each plant is to be divided into two shifts, one to be dispersed to locations within commuting distance of the enterprise, the other to continue work. We believe the shelters at economic facilities are intended for that portion of the essential labor force at work during a crisis—which we have designated the “crisis work force.”
- The size of the crisis work force would vary, but could be up to 50 percent of the total labor force at some enterprises. Using the 50-percent figure, we calculate that the available shelter space at the sample installations studied could accommodate 24 to 48 percent of the crisis work force. The actual percentage of the crisis work force sheltered would be higher because we expect the crisis work force to be less than 50 percent of the total labor force.

18. In addition to the survey of 17 key recovery industries on which the above conclusions were based, we studied 113 plants from five military industrial categories. We found that shelters had been built or were under construction at 70 percent of the plants, as compared with 65 percent of the 150 facilities at the 17 key recovery industries which we surveyed.

19. The Soviet program for geographic dispersal of industry is, as far as we can tell, not being implemented to a significant extent:

- New plants have often been built adjacent to major existing plants.
- Existing plants and complexes have been expanded in place.
- No effort has been made to expand the distance between buildings or to locate additions so as to minimize fire and other hazards in the event of a nuclear attack.
- Previously open spaces in fuel storage sites have been filled in with new storage tanks and processing units.

<sup>2</sup> The lower figure of 0.5 square meter per person is derived from Soviet civil defense publications. The upper bound of 1 square meter is based on an average of figures provided by knowledgeable human sources. The range is consistent with studies of the US Defense Civil Preparedness Agency which recommend 1 square meter as a desirable goal but allow 0.5 square meter as a practical minimum.

The value of overall productive capacity has likewise been increased proportionately more in previously located sites, raising the vulnerability of industry to attack even more.

20. Little evidence exists that would suggest a comprehensive program for hardening economic installations. In some cases, in fact, construction guidelines for the physical hardening of industrial sites appear to have been ignored. Published Soviet civil defense guidelines acknowledge the high cost of such measures and explicitly state that they are to be carried out only when economically feasible.

21. There are only a few human-source reports of training exercises in which hasty hardening techniques have been employed. The Soviets appear to have given greater emphasis to rapid shutdown of equipment than to hasty hardening. The emphasis in this scheme seems to be on protecting vital equipment and installations from secondary damage triggered by prompt effects of a nuclear attack, such as ignition of combustibles, and facilitating longer term recovery of installations after an attack.

22. Overall, we estimate that the Soviets' measures to protect their economy would not prevent massive damage from a US attack designed to destroy Soviet economic facilities. At best, Soviet leaders and civil defense planners are probably confident that, through rapid shutdown and emergency repairs by the surviving work force, limited production at slightly or moderately damaged sites could be restored soon after an attack. We have not assessed the Soviets' long-term ability to reconstruct their economy.

#### Protection of the Population

23. Soviet plans call for in-place shelters and the evacuation of population from urban target areas. Our evaluation of the Soviet shelter program is based primarily on analysis of 28 distinct regions in the USSR including three oblasts, one republic, and 24 selected urban concentrations. Although these areas do not constitute a random sample and represent only a small portion of the total number of Soviet urban agglomerations, we believe they provide a basis for tentative conclusions regarding the pace, scope, and magnitude of the shelter program nationwide. Assessments of the effectiveness of the Soviet evacuation program are highly dependent on the scenario chosen, but tentative evaluations of this program are also possible.

24. The types of shelters we surveyed include built-in (basements), detached (separate bunkers), and subways. Most of the structures are of the built-in type, constructed during the laying down of foundations for buildings. Our analysis of time-series data indicates that about half of the shelters currently in existence were built after 1968; however, there

were wide variations in construction rates among cities and from year to year after 1968.

We have used two different figures in allocating shelter floorspace per person: 0.5 and 1 square meter. Using both these figures against the best estimate of the total floorspace in the urban shelters which we positively identified, results in a total capacity of 3.8 million or 1.9 million people. Extrapolating upward for unevenness of coverage of those areas surveyed results in an estimate that about 10 to 20 percent of the population in these urban areas could be sheltered. Extending this extrapolation to the USSR as a whole, we estimate that the Soviets have probably constructed more than 15,000 shelters nationwide that can protect 10 million to 20 million people—roughly 10 to 20 percent of the total population in cities of more than 100,000 people. We are confident that more extensive analysis would result in an upward, not downward, adjustment of this figure, but we are unable to say by how much.

25. Additional protection would be available to the Soviet population in the form of subway tunnels and stations. The Moscow subway, for example, has 92 underground stations and more than 150 kilometers of tunnels. Assuming a space allocation of 0.5 and 1 square meter per person, we estimate that between 480,000 to 240,000 persons could be sheltered in the station areas and four times that number in the track tunnels, for a total of 17 to 34 percent of the urban population of the city. This total is in addition to the number that would be sheltered in the previously discussed shelters. The five other operating subway systems in the USSR would provide an additional increase in the total sheltered population. We have not included these spaces in our count of the totals because the subways could be intended for evacuation and because of our uncertainty over the existence of life-support systems in the subways.

26. The shelters the Soviets have built are designed to withstand overpressures of 100 to 200 kilopascals (14 to 28 pounds per square inch) on the basis of a "sure safe" criterion. According to our analysis, 50 percent of these same shelters would withstand overpressures of 350 to 1,030 kPa (50 to 150 psi). The hardness range is the 50-percent probability of achieving at least severe damage from a 1-megaton weapon; the range results from our uncertainty about the actual shelter construction techniques.

27. We estimate that 75 to 90 percent of the people in urban shelters would be adequately protected from the blast and other prompt effects of a nuclear attack that was intended to maximize damage to industrial and military targets. On the other hand, evacuation of the bulk of the urban population would be necessary in order to achieve a marked reduction in the total number of urban casualties.

28. Soviet writings state that the order to evacuate cities would be given during the "special period"—a period of high tension and increased risk of war. The order to evacuate would be issued through dedicated civil defense communications networks and disseminated to the public via the mass media. Individual installations would use available means to notify personnel of the time and place for staging their evacuation. Factories, offices, schools, or bus and train stations would serve as embarkation points. According to Soviet planners the population would have only a few hours to prepare for an evacuation following the order to do so. On their arrival at assembly points people would board buses or trains, or begin walking toward their previously assigned relocation areas. Those persons destined for remote areas would be evacuated first to intermediate points, where they would rest and be fed by local authorities. There is no evidence that evacuation exercises in large cities involving the actual movement of people have been practiced. There is evidence that small-scale evacuations are practiced. Where planning exercises primarily involving civil defense staffs for large cities have been conducted the results have apparently been mixed. In an exercise of elements of the Moscow staff in early 1977, the performance of those involved was found unacceptable by city civil defense authorities.

29. Theoretical studies indicate a range of times necessary to accomplish evacuation, depending primarily on the availability of transportation. For evacuation employing motorized transport—buses, trucks, trains, and cars—one to four days would be required for the last group of evacuees to reach their relocation area. If the evacuation was carried out on foot, a week or more would be required to evacuate the larger cities. Using some combination of motorized and foot transport would reduce the required time to less than a week. Unusually severe weather conditions could slow the pace of evacuation and affect a local decision to evacuate. On balance, an average of two or three days would probably be required to evacuate the major portion of the Soviet urban population.

30. Soviet planning recognizes that the evacuated portion of the population must be provided fallout protection. Plans and some materials exist for upgrading existing structures and constructing hasty shelters in rural and exurban areas. However, as a practical matter, we estimate that the bulk of the evacuated population would have about the level of protection afforded by upgraded basements and interior rooms of standard Soviet rural structures. Under ideal circumstances, with a week or so to evacuate urban areas and to modify existing structures and construct hasty shelters, the evacuated population could be afforded high levels of protection.

#### Overall Effectiveness

31. We have calculated the effects of civil defense on the levels of damage and casualties the Soviets might sustain from a US-Soviet nuclear exchange with 1977 forces. We have deliberately chosen to analyze important and sensitive variables—economic damage and casualties—that can be evaluated quantitatively, and have made arbitrary assumptions to deal with the inevitable uncertainties regarding preparations for and conduct of an actual nuclear exchange. This type of analysis involved trading on the realism of the war scenario adopted to gain detail in calculating the consequences—the more detailed our analysis for purposes of calculations, the less likely the calculations would apply to another, perhaps more believable scenario.

32. For example, we assumed a single spasm of weapons launched by US strategic forces from day-to-day alert following a Soviet strike on those forces. This allows us to estimate the level of damage a weakened US retaliatory force could inflict in the Soviet Union under various states of preparations. For purpose of these calculations we have also assumed that in its retaliatory strike the United States would not deliberately target the Soviet population but would choose instead to attack high-value military and economic targets. In our analysis, about 2,200 US weapons were used in an attack optimized against critical Soviet economic targets. These weapons were in addition to those used against military targets and those held in reserve. We assessed the industrial damage and casualties resulting from the attack on military targets as well as from the attack on economic targets.

33. This approach [ ]

[ ] tends to establish a lower limit for the level of casualties such an attack would inflict on the Soviet Union. In effect, it tends to present a "worst case" for the United States, especially if Soviet population casualties are a major criterion.

34. Those command posts and relocation sites that we have identified and located would be vulnerable to US attack. [ ]

We estimate that, with several hours to make final preparations, a large percentage of leaders and communications facilities would survive. [ ]

35. Those measures we have described for protection of the economy could not prevent massive damage. The attack used in our analysis destroyed 80 percent of the economic value of the critical industrial installations in the selected target list. The specific damage levels shown by our analysis are subject to some uncertainty due to the structural damage criteria we used for assessing economic loss. Even

with a week or so of preparations, there would be little reduction in the amount of prompt damage to facilities inflicted by blast. Our analysis of the hardness of shelters at industrial installations and their locations relative to likely weapon aim points indicates that a large percentage of the essential personnel would survive a US attack designed to maximize damage to economic facilities. The Soviet measures for protecting the work force, critical equipment, and supplies and for limiting damage from secondary effects could contribute to maintaining and restoring production after an attack. We have not, however, analyzed the Soviet potential for economic recovery.

36. The extent of losses to the population would depend primarily on the time the Soviets had to prepare for an attack and whether or not they chose to evacuate their urban population (see figure S-2):

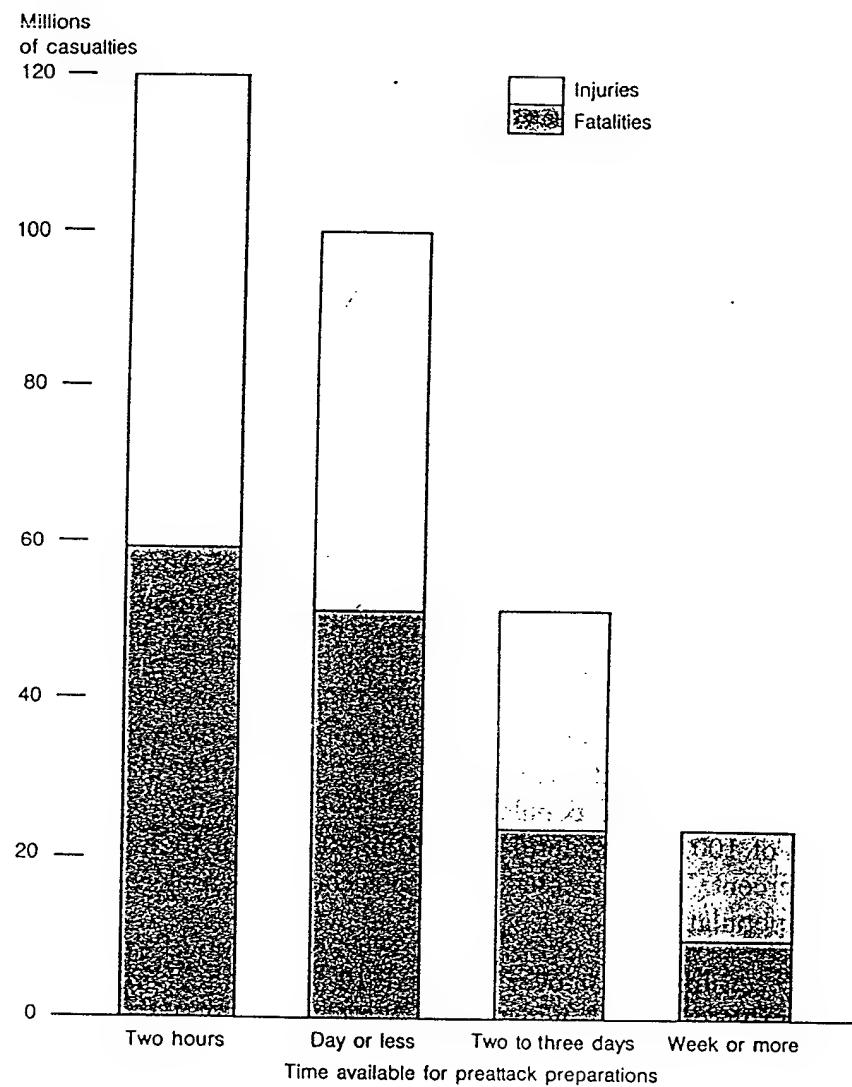
- With a minimal period of preparation (two hours or less), a massive attack could result in casualties from prompt nuclear effects and fallout in excess of 120 million, including 60 million to 70 million fatalities.
- With limited preparations (a day or less), the Soviets could reduce the number of fatalities about 5 to 10 percent. Total casualties would still be in excess of 100 million people, of which the fatalities could be more than 50 million.
- With a moderate period of preparation (two to three days) during which the Soviet civil defense authorities implemented plans for evacuation of urban areas, fatalities of levels cited above could be reduced to about 15 million to 20 million. Casualties, including fatalities, could be more than 50 million.
- Extended preparation (a week or more) could further reduce the level of Soviet fatalities and casualties. With time to complete urban evacuation and to protect the evacuated population, fatalities from prompt nuclear effects and fallout could range from 5 million to 10 million people, with total casualties in excess of 20 million.

37. The above figures serve to point out the important fact that, in the preparations for an attack, the critical decision to be made by the Soviet leaders, in terms of sparing their population, would be whether or not to evacuate their cities. The cost of not evacuating could be in the neighborhood of 100 million casualties.

38. There are of course many combinations of preparation times and attack assumptions which would increase the level of casualties over those shown above. For example the attack could be directed against the population, carried out over an extended period, or timed so as to

Effects of Civil Defense Preparations

Figure S-2



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come while the Soviets were in the process of evacuating their cities. In addition, the United States could use a larger portion of its weapons inventory than that postulated above.

39. We are unable to make a confident assessment of how effective Soviet civil defense would be in rescue and recovery operations following an attack. Our tentative estimate is that, under the most favorable circumstances, stocks of essential supplies would be adequate to sustain the surviving population for weeks and perhaps longer, but the distribution of these supplies would be a critical problem. Under worst conditions, we believe the chances would be poor that the Soviets could effectively support the surviving population with supplies and services.

40. The Soviets almost certainly believe their present civil defenses will improve their ability to conduct military operations and will enhance the USSR's chances for survival following nuclear exchange. They cannot have confidence, however, in the degree of protection their civil defenses would afford them, given the many uncertainties attendant to a nuclear exchange. We therefore do not believe that the Soviets' present civil defenses would embolden them deliberately to expose the USSR to a higher risk of nuclear attack.

#### Future Implications

41. We estimate that the Soviets will continue to emphasize the construction of shelters for the urban population. If this resulted in a pace of construction matching that since 1968, they would, by 1985, increase the number of shelters in the Soviet Union by roughly two-thirds, over the present estimated total. This would increase the minimum percentage of population sheltered in urban areas (with a population of 100,000 or more) from 10 to 20 percent to an estimated 15 to 30 percent. This increase takes into account the projected growth in urban population.

42. We estimate that over the next 10 years, the percentage of population sheltered will increase, but the absolute number of people that would have to be evacuated will also increase because of growth in the urban population. To avoid an increase in the number of people to be evacuated, Soviet shelter construction would have to be higher than the rate we have projected. Thus, the Soviet leaders' critical problem of deciding whether to evacuate, and when to do so, will not change substantially over this period. They may, however, be able to achieve some reduction in the time required to evacuate by increasing the available transportation.

43. Prospects for improvement in measures to protect the economy against attack are mixed. The increase in the number of shelters will probably enable a larger proportion of the work force to be sheltered. But the continuing concentration of economic investment in previously existing plant sites, together with an absence of construction-hardening techniques, suggests that a US countereconomic attack would be about as destructive as at present. We do not believe that the protective measures the Soviets are likely to undertake during the next 10 years would significantly reduce damage from a large-scale US attack designed to maximize destruction of economic targets.

44. Programs for protection of the leadership are solidly established and well advanced. We are confident that this aspect of the program will continue to receive attention, with better protection for leaders at all levels. The continued growth in the numbers of leadership facilities [ ]

[ ] will increase prospects of survival of a large number of Soviet leaders.

45. We have no present reason to believe that in the foreseeable future there will be any significant change in the Soviet leaders' judgment that civil defense contributes to war-fighting and war-survival capabilities, nor do we believe that their uncertainties about its actual effectiveness would be lessened. Thus, we have no present reason to believe that their perception of the contribution of civil defense to their capabilities for strategic nuclear conflict will change significantly.

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## Chapter I

### INTRODUCTION

#### A. Scope

1. This report describes Soviet concepts, plans, and objectives for civil defense; explains the extent, pace, and characteristics of civil defense preparations; evaluates the effectiveness of Soviet civil defense; and estimates the future course and implications of the Soviet program.
2. In addition to these areas, several basic themes underlie the report, including the relationship, on the one hand, between warning (or the time available to make final preparations) and Soviet civil defense programs, and, on the other hand, between observable civil defense preparations and Soviet civil defense plans. These themes and others are carried through the report but are specifically addressed in the sections dealing with the effectiveness of the Soviet civil defense program.
3. The judgments and analyses of effectiveness pertain primarily to the capability of Soviet civil defense to protect the leadership, reduce population casualties, permit the continuing functioning of essential industrial facilities and equipment, and conduct rescue and recovery operations. We also attempt to judge the effectiveness of Soviet peacetime organizations and programs to complete the preparations called for in Soviet plans. When feasible, the report gives both quantitative and qualitative measures of Soviet civil defense, but they *do not constitute a comprehensive net assessment* of Soviet capabilities to recover from the effects of a large-scale attack by US strategic forces. Our judgments and analyses of civil defense effectiveness provide approximations of the impact civil defense preparations could have in reducing casualties and damage. Neither we nor the Soviets could be confident about absolute levels of damage from a large-scale nuclear attack with or without civil defenses, or about the effectiveness of various types of preparations for conducting rescue and recovery operations.
4. The report covers all activities encompassed in the Soviet concept of civil defense, with special attention to the effectiveness of civil defense preparations for survival and recovery during the first few weeks following a US retaliatory attack. It does not cover measures to protect military forces, nor does it attempt to define the longer term capabilities of the USSR to reconstitute its political, economic, and military institutions after a nuclear exchange.
5. This report supersedes the Interagency Intelligence Memorandum on Soviet civil defense (NIO IIM 76-041) published in November 1976. It does not attempt to duplicate the previous IIM in form or detail, although much of the basic intelligence information provided in the previous paper remains valid. All of the findings of last year's report have been reevaluated in light of new information and analysis. This IIM notes those principal findings in the 1976 IIM which subsequent intelligence efforts have either confirmed or refuted.

#### B. Sources and Methods

6. The analyses for this report drew on all available intelligence sources and reflect an extensive interagency research and analysis effort. This effort was guided by a special collection and production strategy developed after the completion of the IIM in late 1976. Under this strategy, responsibilities for taking the lead in research and analysis on the various aspects of Soviet civil defenses were apportioned among the participating agencies.

7. To allow for an in-depth analysis of Soviet civil defense activities, intelligence efforts were concentrated on selected geographic regions and industrial categories. The regions were selected on the basis of geographic location; political, economic, and military importance; and availability of collection opportunities. Industrial categories were selected according to their military significance and importance to post-attack recovery.

8. The report also relied heavily on information available from broadcasts and through the open press, including textbooks and newspapers. The 1977 edition

of the civil defense manual and the monthly publication *Military Knowledge* (*Voyennyye Znaniye*), which is published jointly by the civil defense organization and the Soviet preinduction training organization DOSAAF, have made a significant contribution to understanding of Soviet civil defense methods and programs. It now is clear from other sources that much of the information contained in Soviet civil defense literature is an accurate reflection of ongoing programs. Thus, these sources provide a standard for measuring Soviet progress in implementing the programs. It is also recognized, however, that the goals and activities described in Soviet civil defense literature may be somewhat distorted. Such literature contains propaganda and does not cover details of the civil defense program considered classified by the Soviets. (See Bibliography, annex F.)

9. Human sources have provided a large body of information on almost all aspects of the civil defense program. Collection was aimed primarily at former residents of the USSR with backgrounds which gave them access to details on civil defense activities. Their debriefings have provided some insights on how the plans described in Soviet literature work in reality and have given important descriptions of civil defense facilities which provided signatures for use in photointerpretation.

10. At the same time, we continue to have reservations concerning some information from these sources on the Soviet civil defense programs. Aside from attendance at lectures, relatively few sources participated directly in the activities of the civil defense organization at their places of work or study. Unless they held supervisory positions, or their professional responsibilities brought them into contact with specific aspects of civil defense such as shelter construction, their information often tended to be superficial. In addition, by reason of their backgrounds, these sources were apt to be more negative regarding the program than might be true of the general population. Where specifically queried, however, most agreed that if a real crisis arose, civil defense directives would be complied with despite any public apathy or the tendency of the sources to ridicule the program.

11. Information from attaches and visitors has also helped in confirming or negating leads from other sources, although, as foreigners subject to stringent travel restrictions, they were unable to report in any depth on civil defense activities. Clandestine sources have also provided valuable inputs in terms of their

experiences with the program and identification of important civil defense facilities.

12. Satellite photography dating from 1968 to the present was used extensively in the identification of the most visible aspects of civil defense, and made its most important contribution in the identification of shelters. For many of the areas, most of the detached shelters were identified. However, a significant number of existing basement shelters in many of the areas studied were probably not identified. While overhead photography is ideally suited for identification of shelters and other externally visible aspects of the civil defense program, it has been of little use in determining what protective measures have been taken within industrial facilities.

13. Knowledge and understanding of Soviet civil defenses by the Intelligence Community increased substantially during the past year. While there are still gaps in the data base and deficiencies in understanding some aspects of the programs, there is now an improved basis for assessing the current extent, pace, and effectiveness of the civil defense effort. Programs for the protection of the population are better understood than programs to protect the economy (especially with respect to the impact on long-term recovery). There are also uncertainties about Soviet motivations and intentions and about the likely progress of the Soviet civil defense effort over the next decade.

### C. Attribution

14. This Interagency Intelligence Memorandum was approved by the Director of Central Intelligence with the concurrence of the National Foreign Intelligence Board on 1 November 1977. It was prepared under the auspices of the National Intelligence Officer for Strategic Programs, National Foreign Assessment Center. Its preparation was a joint undertaking of the Central Intelligence Agency; the Defense Intelligence Agency; the National Security Agency; the Bureau of Intelligence and Research, Department of State; and the offices of the Assistant Chief of Staff for Intelligence, Department of the Army, of the Director of Naval Intelligence, Department of the Navy, and of the Assistant Chief of Staff, Intelligence, Department of the Air Force. The Memorandum was drafted by the Central Intelligence Agency, based on research conducted by the participating intelligence agencies. The working group was assisted by the Command and Control Technical Center, Defense Communications Agency, through the Assistant Secretary of Defense for

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Programs Analysis and Evaluations, and by representatives of the Defense Civil Preparedness Agency and the Arms Control and Disarmament Agency. Mr.

[ ]

chairman of the working group which prepared the memorandum.

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## Chapter II

### CIVIL DEFENSE IN SOVIET STRATEGIC POLICY

1. In Soviet writings on military doctrine and strategy, civil defense is integrated into a general scheme of the likely origins, course, and consequences of nuclear war. In that scheme, Soviet deterrence relies on convincing potential enemies that they cannot win a nuclear war against the USSR. Should deterrence fail, civil defense would play a dual role in contributing to (1) maintaining a functioning logistical base for operations by regular armed forces to "win" the war and (2) enabling Soviet recovery from war damage.

#### A. Military Strategy and Requirements

2. Civil defense has origins dating from the beginnings of the Soviet regime and especially from its experience in World War II. Currently, Soviet planning for civil defense is driven primarily by the possibility of war with the United States, rather than by contingencies such as a Chinese or other third-country attack. While Soviet civil defense writings discuss US motives and capabilities at length, references to China are rare. The Soviets probably recognize that a civil defense capability against US strategic forces would also serve against any third-country attack.

3. Soviet strategists regard nuclear war as possible, although they do not assign a specific degree of probability to it. They are uncertain whether war with the United States could be contained short of a large-scale nuclear exchange, but their public commentary generally disdains limited uses of strategic nuclear weapons as envisioned by the United States. It has been the Soviet view that initial nuclear strikes would attempt to destroy as much as possible of the other side's retaliatory capability and to disrupt mobilization, economic activity, and command and control. These strikes have been considered likely to exert a decisive influence on the outcome of the war, although a ground offensive would probably be necessary to secure "victory." Because of the importance attached to the initial nuclear strikes, Soviet strategists have

emphasized the value of preemptive attack. They believe an initial nuclear attack would be preceded by a "special period"—a period of high tension and increased risk of war, during which final preparations for conflict would be made.

4. There is additional evidence that links Soviet civil defense to strategy for the conduct of military operations following an initial nuclear attack. Soviet strategists expect the ground offensive against NATO, and associated sea and air operations, after a nuclear exchange, to be characterized by rates of advance and levels of intensity exceeding previous warfare. The logistical requirements for the Soviet offensive led the Chief of Civil Defense, General of the Army A. T. Altunin, to observe in 1974 that "in contemporary war, destruction of the functioning of the logistical base has become one of the main war goals." Accordingly, one of the civil defense program's main tasks is described as ensuring "the continuous functioning of the economy" in support of the Soviet offensive. Thus, the civil defense program links all aspects of the national economy to Soviet economic mobilization plans for conversion to wartime requirements.

5. Soviet program choices for civil defense have been affected by shifts of emphasis in Soviet military strategy, because of the supporting role envisioned for civil defense in military operations. Change in military strategy, for example, was the reason for the change in emphasis on urban shelter construction as compared with city evacuation measures for population protection. Between 1962 and 1970 Soviet civil defense officials repeatedly described evacuation measures as "the most effective method for protecting the most important industrial-economic and administrative centers." During this period the Soviets were confident that NATO mobilization and US strategic force activity would provide enough warning to permit urban evacuation, but technical improvements to strategic forces made many Soviet strategists concerned that the warning or special period might be very brief. Moreover, evacuation, which would be

subject to observation by US reconnaissance, might signal an impending Soviet preemptive strike. Shelters were therefore preferable to evacuation measures under such circumstances, as they could be occupied on short notice; movement into shelters would also be much less noticeable.

6. Soviet civil defense officials argued against this new approach—giving priority to shelters for population protection—by demeaning the importance of surprise in nuclear war. Nevertheless, the military strategists' perception of the role of surprise and their preference for shelters over evacuation, prevailed after 1970. A Soviet history of the civil defense program explained in 1975:

In the recent past, evacuation and dispersal were considered the main means of population protection. Now, when missile-nuclear weapons and strategic aviation have undergone further development and improvement, the aggressor may be tempted to try a preemptive nuclear strike. In these circumstances, time for implementing civil defense protective measures may be extremely limited, especially time for evacuation and dispersal. Consequently, today the plan for sheltering the population in protective structures is given the first place as the most reliable way of preserving people's lives from missile-nuclear weapons.<sup>1</sup>

7. First priority in implementing this new approach went to constructing shelters in economic installations.<sup>2</sup> This began in the late 1960s and is continuing. General Altunin reaffirmed this priority in 1974 when he explained that "the scope and character of civil defense measures" would depend "on the economic and defense significance of individual installations." Nevertheless, Soviet civil defense planners continue to rely on evacuation of the urban population and dispersal—relocation of workers to sites within commuting distance of their work places—in addition to shelters as a means of protecting the population.

#### B. Immediate National Survival and Recovery Requirements

8. The Soviet civil defense program has for years included a comprehensive, broadly based effort to

<sup>1</sup> Kotukov, Oglolbin, and Sgilevskiy, *Civil Defense in the Past and Present*, Moscow, 1975.

<sup>2</sup> As used in this memorandum the term "economic installations" refers to industrial facilities, design bureaus, research and development installations, and utilities engaged in the production of goods and services.

convince people that nuclear war is survivable, and to instruct the population on how to survive. As Altunin emphasized in his first public statement as Chief of Civil Defense:

The task of propaganda is to see to it that every Soviet person believes firmly that there is a defense against any weapon, even the most modern.

This emphasis on programs to inform people about nuclear war to offset widespread doubts concerning survival is consistent with US research findings that an informational program is essential to effective disaster response. Human reporting evinces widespread skepticism about surviving nuclear war. Resistance to propaganda may be stronger among our sources, who have left the USSR, than among those who remain. Nevertheless, reminders in Soviet civil defense literature (for example, "a serious attitude toward training is demanded from all trainees") reinforce the impression that public attitudes remain skeptical.

9. While the Soviets do not discuss the aftermath of nuclear war in any detail, a phrase used by Altunin in his first public statement as Chief of Civil Defense about continuing "leadership by party, military, and economic Soviet organs" implies an effort to preserve the existing internal political order. Indeed, as will be described later, protection of the leadership is probably better developed than any other aspect of civil defense.

10. As for economic survival, Soviet civil defense writings concentrate on immediate support to the war effort and the interaction of economic mobilization and civil defense planning. Coordination of the civil defense plans and economic mobilization plans is effected by the directors of enterprises who are responsible for both; the civil defense posture of an enterprise will depend on the role envisaged for it in its mobilization plan—that is, whether it will convert to wartime production schedules for both military and essential civilian needs. According to their writings and civil defense planning, the Soviets do not envision a need to continue full production to satisfy their wartime military production requirements.

#### C. Other Factors Influencing Civil Defense Policy

11. Other factors influence the Soviets' choice of means for achieving civil defense objectives. They are influenced by bureaucratic conflicts stemming from the decentralization of civil defense funding among

the many ministries, industries, and plants and among regional and local government elements. Beyond bureaucratic conflicts, actual resource scarcities complicate the civil defense program. It is difficult to judge the scope of such problems, however, because the Soviets tend to discuss them in generalities or to give individual examples. Reinforcing factors enhancing the civil defense program include the perception of the Soviet leaders that civil defense strengthens social morale and is important for disaster relief.

12. The special bureaucratic interests inherent in industrial activity and in military programs present obstacles to Soviet attainment of civil defense goals. Civil defense efforts to disperse industry are still hampered by opposition from economic officials. While civil defense manuals recommend building numerous small plants duplicating each other's production, Soviet planners, in the interest of centralized control, prefer large projects such as the Kama River Truck Plant. A regulation has reportedly been adopted by the Council of Ministers forbidding construction of new factories or expansion of existing plants within city limits, in part for civil defense reasons. Yet, Soviet factory directors have opposed locating additional facilities away from the home plant because of difficulty of administration and have presumably obtained exceptions from the regulation. In some cases reconstruction of existing plants has been more economical than new construction, a practice also contrary to dispersion.

13. Similarly, Altunin's 1974 recommendation for "heightening the self-sufficiency of economic regions and republics" is incompatible with Soviet centralized planning and the political commitment of integrating regional economies into a national unit. Other documentary sources suggest that Altunin's concern relates to the difficulty of interregional delivery of raw materials and semifabricated goods along transportation routes damaged by nuclear attack. The development of "territorial production complexes" (TPKs) intended to overcome the peacetime inefficiencies of unnecessary interregional shipments has moved the Soviet economy toward Altunin's objective (see chapter V, section B), but patterns of interregional dependence continue to exist and are not likely to be eliminated. Another example of a bureaucratic obstacle to the civil defense program is the incentive structure for Soviet industrial managers, which emphasizes current production and makes them reluctant to divert resources for civil defense training and even causes them to delay shelter construction and other expenditures for civil defense for as long as possible.

14. Conflicts between civil defense and other military requirements were in part responsible for the Soviet decision to plan for evacuation of some residents on foot. Soviet planning for the period prior to a nuclear exchange envisages mobilization of some transport assets into military units, some for military shipments, and some for civil defense. Planning requirements exceeded available transportation resources during the 1960s, as one civil defense writer noted:

The experience of exercises shows that possibilities of obtaining [any kind of transportation] resources are sharply curtailed, and considerable difficulties arose.

As late as 1970 this resource conflict had a negative effect on the quality of planning. As an example of a wider problem, one Soviet author noted that the locally developed plan for military rail shipments and for industrial and civil defense rail shipments around one medium-size city demanded more than twice as many trains as the rail net could carry. Consequently, senior civil defense officials pressed vigorously for larger transport allocations.

15. The Ministry of Defense takeover of the civil defense program, however, led to an alternate solution of the problem. Between 1965 and 1973, walking was not usually included in Soviet lists of the means of evacuation. In 1973, however, Altunin, as new Chief of Civil Defense, wrote:

We have been teaching an oversimplification: gather your things and wait to be transported out. This is not to be taught now.... The population should be evacuated by combined means: on foot and by various means of individual and public transportation.

He stated that this change would allow a faster evacuation than total reliance on available transportation. While we have not conducted movement analysis to confirm Altunin's assertion, we believe the emphasis on foot movement, either because of transportation shortages or limited capacity of roadways, reflects a Soviet decision to give priority to military movements over urban evacuation. In any case, we believe that the change to the combined method also gave military planners greater flexibility in road traffic control, probably reduced the incidence of unrealistic planning for transportation, and improved the chances that transport allocations to civil defense would be available. Although it is evident that the evacuation

and dispersal plans of some civil defense organizations specify automotive and rail transport, the 1977 Soviet civil defense textbook reiterates reliance on the "combined means" of evacuation.

16. Civilian formations and regular military and military civil defense units have been used to cope with natural disasters and industrial accidents. Some Soviet spokesmen have cited this activity as justification for the expansion of the civil defense program. These assertions are false, because the nature, scope, and rate of expansion have exceeded that necessary for these limited ends. However, the participation of civil defense personnel in disaster relief is seen as beneficial to the civil defense effort. In his 1976 book *Formations of Civil Defense in the Struggle Against Natural Calamities*, Altunin wrote that, in coping with natural disasters:

Formations of civil defense acquire in peacetime practical work experience in complex conditions; therefore, participation of the personnel of formations in liquidating the consequences of natural disasters and industrial accidents is a school of combat training for them.

#### D. Civil Defense Programs and Priorities

17. We have attempted to determine how Soviet statements about civil defense priorities accord with actual priorities suggested by evidence on civil defense preparations. Soviet statements have consistently listed the priorities in order of importance as:

- Protection of the population.
- Maintaining continuity of economic activity in wartime.
- Liquidation of the consequences of an enemy attack.

18. Using evidence on the implementation of the Soviet civil defense program available up to publication of the 1976 IIM on Soviet civil defense, we listed the following priorities:

- Protection of the leadership.
- Protection of industry and the essential work force.
- Protection of the general population.

Further evidence and analysis during the past year have clarified our understanding of Soviet stated priorities. We now believe that the program imple-

mentation is consistent with Soviet priorities if viewed in perspective (see figure II-1).

19. It is apparent that the Soviets view the saving of human resources—the leadership, essential personnel, and the population generally—as the key to all other civil defense objectives. It is also clear that the Soviets have designed and are implementing a program in which effort and resources are divided among the priority areas stated in Soviet writings. Within each of these areas, effort and resources are further divided among a number of intermediate tasks. This results in a situation in which progress is made in all priority areas, but at different rates for intermediate tasks within the major areas.

20. In the first priority area of population protection, programs for the protection of various levels of leadership have been undertaken concurrently, with emphasis gradually shifting from more to less "critical" elements. Similarly, the extent of allocation of resources to sheltering personnel at economic installations has depended on the criticality of both the installation and its personnel to postattack military operations and national recovery. The Soviets implement programs in the other two broad priorities in a similar fashion. Also, programs to carry out the three

Figure II-1

#### Objectives and Priorities of Soviet Civil Defense

Program Objectives	Priority Tasks
Protection Of Human Resources	Sheltering and relocation of the leadership Sheltering and dispersal of essential workers Sheltering and evacuation of the urban population Stockpiling food and medical supplies
Continuity of Economic Activity in Wartime	Integration of civil defense and economic mobilization plans Rapid shutdown of industrial facilities Permanent and hasty hardening of installations and equipment Crisis relocation of economic enterprises Stockpiling reserves of materials Geographic dispersal of industry
"Liquidation of Consequences of Enemy Attack"	Preparation of military and civil defense formations Training in rescue and recovery Preparations for distribution of food and essential supplies

~~SECRET~~

categories of civil defense preparations intermesh or complement each other. As Altunin wrote in 1973:

Successful solution of this problem [continuity of production] depends primarily on successful solution of the problem of population protection.

Thus, the priority given to protection of the population derives in part from its importance for the objective of industrial protection.

21. Overall, in efforts to "maintain continuity of economic activity in wartime," the Soviets have made most progress in sheltering workers and have accomplished least in dispersal of industry—a costly and long-term endeavor especially vulnerable to considerations external to civil defense. Meanwhile, the Soviets have a continuing program to construct urban shelters intended, in conjunction with evacuation, to protect the population.

22. In view of the related nature of the three main priority areas described by the Soviets, it has been decided not to organize the material in this IIM around Soviet priorities but to focus on the following four areas:

- The organization of a nationwide staff with adequate personnel and resources to plan and implement civil defense programs, including necessary training.
- The protection of leadership by construction of urban shelters, hardened relocation sites, and communications facilities.
- The protection of economic assets by sheltering and dispersing workers and training them to repair war damage, as well as by dispersal and hardening.
- The protection of the population by blast and fallout shelter construction in urban and rural areas, and by evacuation.

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## Chapter III

### ORGANIZATION AND FUNCTIONS

1. The Soviet civil defense organization is composed of staffs responsible for the planning and supervision of civil defense activities during peacetime and for the direction of the operating elements charged with carrying out civil defense tasks during wartime. The work of these staffs is controlled by the military at the national level through the military districts.

#### A. Organizational Structure

##### National Organization

2. Since 1971 the "Civil Defense Staff of the USSR" has been a component of the Ministry of Defense; since 1972 it has been headed by A. T. Altunin, promoted to General of the Army in 1977. The internal structure of the national civil defense staff appears to resemble that of main directorates of the Ministry of Defense. At least 12 general officers have been identified at the national civil defense staff level; many of them were reassigned from command or staff positions in military districts in connection with the subordination of the civil defense program to the military in 1971 and 1972.

3. *Subordinate Staffs.* Soviet civil defense staffs are of two kinds: territorial and functional. Territorial staffs, subordinate to the civilian territorial administrative authority, are found at the national, republic, oblast, city, and rural and urban rayon echelons. Functional staffs are attached to each all-union and republic ministry in the Soviet Union. Also, there are functional staffs subordinate to the directors of factories, schools, educational institutions, research institutes, farms, administrative agencies, hospitals, and similar bodies. The functional staffs are also referred to as "installation staffs," a translation of the Russian term *obektovye shtaby*. Figure III-1 shows the relationship of the territorial and functional or installation staffs to each other and to other important elements in the civil defense hierarchy, particularly the military districts.

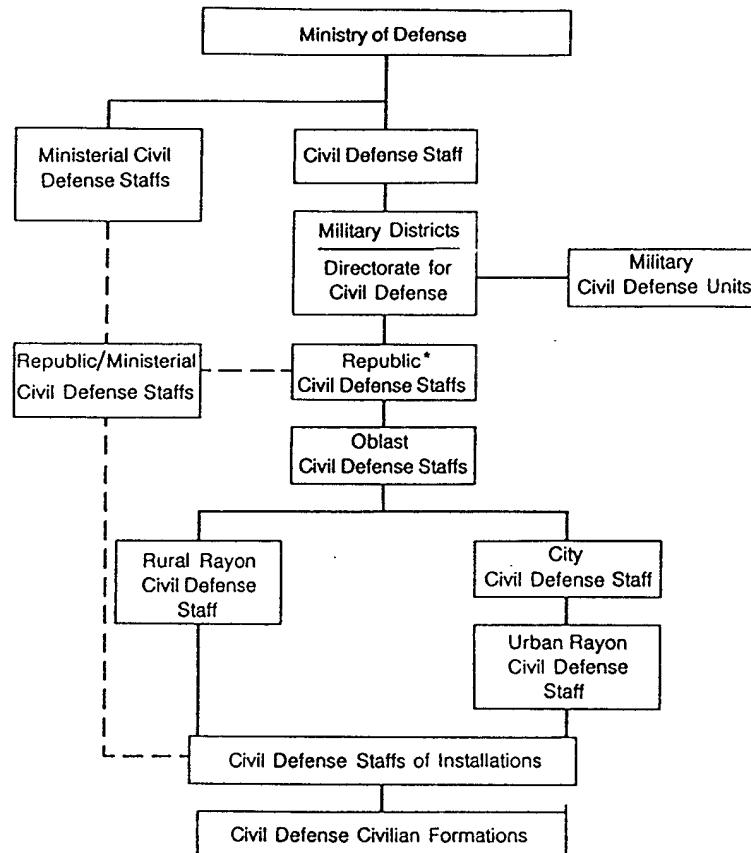
4. *Military Districts.* In 1971 and 1972 the 16 Soviet military districts received operational control over the territorial and functional civil defense staffs as well as military civil defense troops in their areas.

Before that the role of the military districts' "sections for civil defense," headed by an "assistant to the commander," had been restricted to control of the military civil defense units. As a consequence of the expansion of the authority of the military district commanders, by 1973 the former "sections" were upgraded to "directories" and the "assistants" to "deputy military district commanders." The directorate for civil defense of the military district has probably become the main link between the national staff and the territorial staffs at the republic, oblast, and lower governmental levels. For 13 of the 15 Soviet republics, boundaries of the military districts coincide with republic boundaries. In these republics the territorial civil defense staffs probably function as subordinate to the military district deputy commander for civil defense. However, the Russian Soviet Federated Socialist Republic (RSFSR) and the Ukrainian Soviet Socialist Republic contain more than one military district. As late as 1972, the RSFSR territorial civil defense staff administered subordinate territorial staffs through intermediate organizations called "operational zones." There is evidence that subsequently, in connection with the expansion of their authority, the military district commanders in these two large republics took control of the operational zones. It is unclear what the current relationship is between the military districts within the Ukrainian SSR and the RSFSR and the territorial civil defense staffs.

5. Details of the 1971-72 resubordination to the military districts of the territorial civil defense staffs below the republic level show that this was a controversial move engineered by the military in defiance of a Central Committee decision to delay a final resolution on the overall structure of civil defense until the end of 1972. A Ministry of Defense proposal made as early as 1969 recommended organizational changes because of disputes with Chuykov's staff over command relationships, access to transportation resources in event of war, and military suggestion for changes in civil defense policy. The determination of the Ministry of Defense to resolve these disputes in its favor was one factor leading to the reorganization

## Organization of Soviet Civil Defense

Figure III-1



\*Two of the 15 Union Republics (the RSFSR and the Ukraine) extend geographically across the boundaries of several Military Districts. In these cases the precise relationship of the republic civil defense staffs to the Military District is uncertain.

~~SECRET~~  
which subordinated civil defense to the MOD, the replacement of Chuykov's deputies by officers from the military districts in early 1972, and finally to the replacement of Chuykov himself by Altunin in July.

**6. Role of the Territorial Staffs.** Territorial civil defense staffs at republic, oblast, city, and rural and urban rayon levels are components of the respective civilian administrative authorities (from oblast down, these authorities are the "executive committees of the Soviets"). The territorial staffs are manned by a mixture of active-duty military and civilians, many of whom are reservists or retired. In practice these staffs form a chain of command through which they report primarily to the military district directorates for civil defense. The staffs are the main operating bodies for civil defense in their territories. At each level the integration of the civil defense staffs with the local

administrative structure provides a forum for coordination between civil defense officials and local government. The mission and functions of the territorial staffs are as follows:

- Planning and supervising the construction of shelters and training sites in their areas and conducting inspections.
- Seeking compliance by other officials and installation staffs with civil defense requirements: for example, for location of new industry, procurement of equipment, and preparation of civil defense plans.
- Maintaining plans and records for evacuation and dispersal at the city and rayon levels, in conjunction with local evacuation commissions. (These commissions are headed by a deputy

chairman of the local executive committee and have members representing the local party committee, the public services, housing authorities, the police, and the military commissariat.<sup>1)</sup>

- Evaluating civil defense exercises at installations in their areas, running "socialist competition" between civil defense teams, organizing territorial nonmilitary civil defense formations, and organizing civil defense courses for the leaders of civil defense formations.
- Organizing activity in response to natural disasters, industrial accidents, and other local emergencies.

<sup>1)</sup> The military commissariat is part of a system to administer manpower mobilization and to determine the wartime assignment of all those liable for military service.

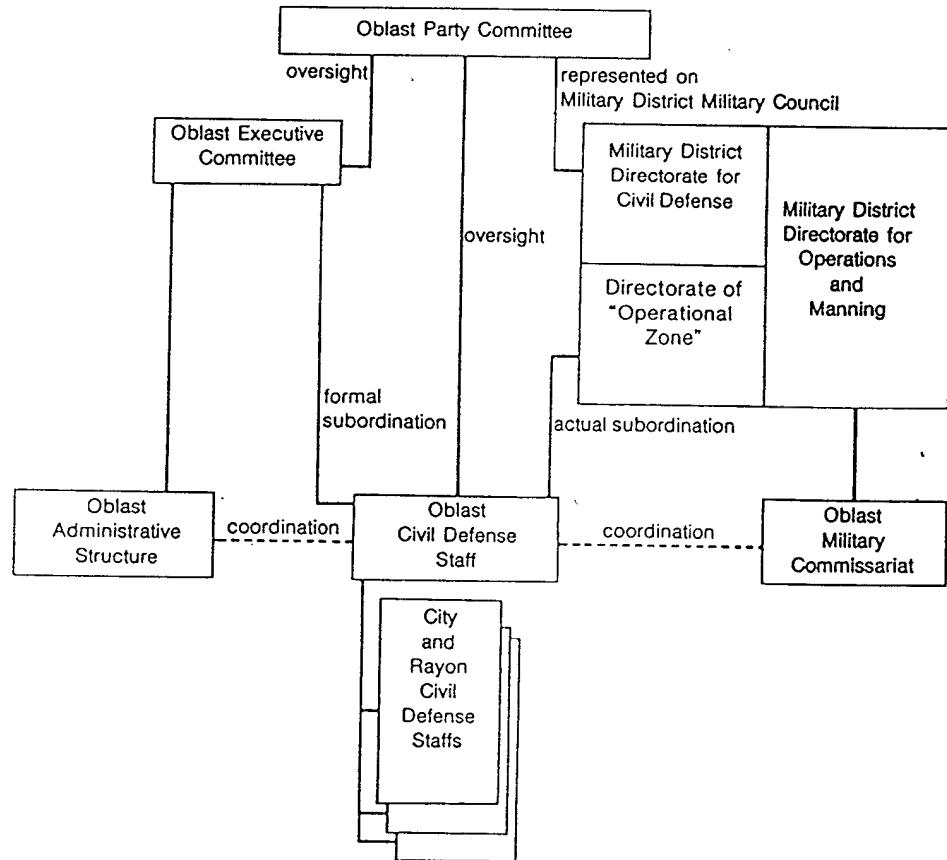
7. Figure III-2 shows the relationship of an oblast civil defense staff to the other local authorities. Most of the functions of the oblast and other territorial civil defense staffs involve much coordination and persuasion of officials from other bureaucratic hierarchies to do things that they regard as secondary to their principal functions.

8. *Role of the Party in Civil Defense.* As the civil defense staffs are not subordinate to the officials with whom they deal, conflicts often result in arbitration of disputes by the local party committee according to the usual Soviet pattern. As the military newspaper, *Red Star*, noted in January 1977,

One cannot manage here without party influence on those who are cool to problems of civil defense or who consider them secondary....

Relationship of Oblast Civil Defense Staffs to Other Local Organizations in the USSR

Figure III-2



Analysis of open Soviet sources suggests an increase in party involvement in civil defense matters during the last few years. One source said that when factories did not participate in civil defense training in L'vov, the directors came under pressure from party organizations. Similar pressure occurred in Leningrad when a rayon party secretary threatened to reprimand a factory director whose newly built shelter did not meet specifications.

9. *Military Commissariats.* Certain of the responsibilities of the territorial civil defense staffs substantially overlap those of the military commissariats. Both are concerned with manpower and economic mobilization problems including allocation of transport. The commissariats are subordinate to the Ministry of Defense and, like the civil defense organization, they parallel the civilian administration at every echelon. Before the transfer of civil defense into the Ministry of Defense in 1971, failures of civil defense staffs to coordinate effectively with the military commissariats were apparently common. Since the transfer, the integration of civil defense plans with local mobilization plans has probably improved significantly.

10. *Role of Functional Staffs.* The functional civil defense staffs attached to ministries responsible for segments of Soviet economic or social programs are engaged primarily in planning civil defense programs for these ministries. They correlate civil defense plans with the periodic plans of the ministries (for example, the quarterly, yearly, and five-yearly plans for economic sectors).

11. The director of each Soviet installation is also designated "chief of civil defense" for that installation. In peacetime practice, however, he delegates his responsibility for civil defense to a "chief of staff of civil defense," who may do this job either full- or part-time and may or may not have assistants. The number of personnel in the "installation civil defense staff" is determined by the ministry to which the installation belongs.<sup>4</sup> The number of full-time staffers is usually proportionate to the size of the installation, although this pattern varies also according to the significance of the installation. Normally the members of the installation staffs are retired military officers, judging by both human reporting and overt Soviet sources. Retired officers may be given these positions to take advantage of their military experience and to provide employment for individuals who would otherwise be unemployable at their accustomed status and income level. Moreover, the average reported wage of a civil defense staff member in institutes and industrial facilities is less than that of the average industrial worker. The persons with an adequate educational

level most likely to take these jobs are therefore retired military officers who are also collecting pensions.

12. The functions of the chief of the civil defense staff at an installation are to prepare installation plans and to supervise the training of civil defense civilian formations and other personnel. The chief of staff oversees the installation's evacuation commission, consisting of representatives of the party organization, the trade union committee, the personnel department, the civil defense staffs, and the workshop heads. He makes plans for the evacuation and dispersal of workers and, in those cases where the installation has associated housing, their families. The chief of staff is also responsible for access to and maintenance of any available shelter or supplies.

#### Operating Elements

13. The operating elements of the Soviet civil defense program—organizations which will actually carry out postattack recovery operations—may be divided into two general categories: military civil defense units and civilian civil defense formations.

14. *Military Civil Defense Units.* Civil defense regiments and independent battalions (see section C for a description of their number and manpower) are stationed near large cities but outside the zone of prompt nuclear effects from strikes on likely targets. Among the missions of the regiments are to establish communications, reconnoiter and mark contaminated zones, perform decontamination, open blocked transportation routes, and participate with the civilian formations in emergency rescue and repair work.

15. Training of enlisted personnel in civil defense regiments is according to standard Soviet Army practice. These conscripts, serving for two years, may undergo specialist/NCO training for six months at one of at least five known civil defense training battalions, or they may go directly to operational units for basic training and subsequent low-skill assignments. The curriculums of specialist training are reportedly nearly identical to similar specialties in other Soviet armed forces units.

16. Unit training is carried out in "training sites"<sup>5</sup> erected at most, if not all, garrisons. The sites are used

<sup>4</sup> "Training site" is the correct translation of *uchebnyi gorodok*, a term that has sometimes been rendered "training village." Training sites are the most elaborate of Soviet training facilities for civil defense. Soviet civil defense literature also identifies two less elaborate kinds of training areas: "simulation grounds" (*naturniye uchastki*) and "training centers" (*uchebnye tsentry*). One example given in a Soviet journal of a simulation ground was a construction project to which civil defense teams were sent to combine work on the project with a civil defense exercise. A training center is often simply a shelter in which lectures are given or the wearing of gas masks and protective clothing is demonstrated.

<sup>5</sup> Yegorov, Shlyakhov, and Alabin, *Civil Defense*, 1977 ed., p. 18

to simulate conditions after a nuclear attack, including fires, damaged buildings, rubble, and broken water mains and powerlines to be reconstituted. Training while wearing gas masks and protective clothing is emphasized. Personnel of the civil defense regiments also participate in joint exercises at factories in their areas with civilian formations and, to some extent, in disaster relief and industrial accidents. A former NCO of a civil defense regiment of the Turkestan Military District reported that as of April 1976 his unit participated, along with civilian formations, in training exercises simulating wartime deployment.

17. Officer candidates for the civil defense regiments attend a four-year course at a commissioning school in Balashikha near Moscow. The contents of the course are unknown, but it can be assumed to deal in depth with the missions of the civil defense regiments, leadership training, political education, and general military subjects. For officers scheduled for promotion to regimental or deputy regimental commander, there is an advanced course at Novogorsk near Moscow. There is also a senior NCO school at Noginsk.

18. *Effectiveness of Military Civil Defense Units.* The extensive experience of the Soviet armed forces in training, particularly in narrow occupational specialties, implies that the civil defense troops are well trained to perform effectively within the limits of their duties. Officer training is also according to standard Soviet Army practice. Graduates of Soviet commissioning schools are acknowledged in the Soviet military press to need further training and seasoning once they enter operational units, but it is likely that their professional preparation is adequate for their duties.

19. *Civilian Formations of Civil Defense.* The formations are teams made up of selected personnel at all installations and facilities of the national economy, educational institutions, and communal services such as utilities and hospitals. Trained and organized in peacetime, these formations have the following missions:

- Preparations in the period before an attack for the protection of workers and other segments of the population.
- Reduction of losses to plants and equipment.
- Emergency rescue and repair work following an attack, to aid wartime operation.

In practice, the Soviets appear to regard these formations as primarily intended for postattack emergency rescue and recovery operations. For

example, there is little evidence of training or involvement of the formations in preattack hasty hardening of facilities.

20. Soviet texts and human sources describing the organization and functions of the formations identify two types: territorial and installation. The territorial formations are directly subordinate to the territorial staffs and are drawn from workers of city services such as utilities, construction trusts, and medical facilities. In addition, according to Soviet regulation, territorial formations include those organizations "whose productive activity in wartime will not be essentially different from their peacetime activity and may be drawn upon for civil defense tasks in their existing production structure."<sup>4</sup> This regulation applies to communication, health, transport, retail, supply, food services, and veterinary and agrotechnical organizations.

21. Installation formations found at educational institutions and economic installations are also of two types: services and general. Each formation is supposed to be drawn from a relevant division of the plant; for example, the formation for communications service for civil defense is based on the installation's peacetime communications division, the service for "maintenance of public order" on the guard force, and the "firefighting service" on the volunteer fire squad. In addition, "each work shift is organized into a . . . formation or subformation by workshop, section, or brigade."<sup>5</sup> Recent reports have tended to confirm the adaptation of the existing plant organization in creating civil defense formations. Rescue, medical, and firefighting detachments are the most common types, although others such as reconnaissance groups and decontamination squads exist. While the formations are intended for postattack operations at their own installations, the territorial authorities are empowered to allocate installation formations as necessary throughout the area of recovery activity.

22. The Soviets may have overcome a deficiency referred to in the writings of the 1960s that military mobilization would withdraw members of the civil defense formations. In plants that would continue to produce during a war, reservists reportedly receive exemptions from mobilization; in other plants, reservists are not required to join the formations. The number of people designated for participation in these formations is uncertain. Applying guidelines issued by Altunin in 1975 to the total work force, the number should be upwards of 16 million. An extrapolation of

<sup>4</sup> Yegorov *et al.*, op. cit. pp. 22-23.

<sup>5</sup> Ibid.

estimates by human sources generally supports an overall estimate in the tens of millions. However, some percentage of these formation members participate only in a perfunctory way.

**23. Training of Civilian Civil Defense Formations.** The training schedule for the formations consists of the standard 20-hour civil defense course outside of working hours, four days' practical training during working hours, and one eight-hour "tactical-specialized" exercise during working hours each year. In addition, every three years the formations participate in integrated exercises at their installations (begun in 1975) or at the district level (begun in 1976). The quality of this training varies widely. Unclassified Soviet writings cite examples of well-trained formations, but only five human sources have given positive evaluations of the formations, and two of them restricted their comments to a firefighting team and a sanitation team, respectively. These sources consistently ascribe a higher priority to maintaining industrial output than to civil defense training and exercises. As a result the civil defense staff has accepted the principle of combining civil defense exercises with repair work on an installation or other useful work, insisting only that a tactical scenario be followed. Both unclassified documents and human sources detail frequent abuse of this practice by factory directors who place the emphasis on repairs rather than in the civil defense content.

**24. In addition to the training sites at civil defense regimental garrisons described above, some sites** ~~at~~ **at** economic installations and other areas in the USSR. According to the journal *Military Knowledge*, there were 27 training sites in Moldavia in 1975, and according to Radio Vilnyus, 47 in Lithuania in 1976. Because of the limitations in our search for training sites, we cannot yet judge with confidence the scope and rate of implementation of this program.

**25. Effectiveness of Civilian Formations.** There are conflicting indications of the likely effectiveness of the formations. Human sources' evaluations of the formation training with which they were familiar are tabulated in table III-1. About half of the sources expressed views about the effectiveness of the formations. Among them, negative evaluations outweighed positive by a ratio of 5:1. On the other hand, despite the evaluations of these sources, many formations during wartime would be performing familiar functions in a familiar setting. Some of the formations have also gained practical experience in

Table III-1  
Human-Source Views on Effectiveness of Nonuniformed Civil Defense Formations

Relationship To Civil Defense	Attitude Toward Formation Effectiveness				Totals
	Positive	Negative	None Reported		
Active participants	4	13	7		24
Nonparticipants .....	1	12	24		37
Total .....	5	25	31		61

fighting forest fires and other natural disasters as well as in repair work following major industrial accidents, although human and overt reporting suggests that specialized territorial formations have primarily reacted to these emergencies.

**26. Shortages of specialized civil defense equipment** would hamper the effectiveness of some formations. Evidence on civil defense equipment in factory inventories is ambiguous, and knowledgeable sources on the subject are rare. Although many sources report the presence of gas masks and protective clothing at industrial installations, the evidence varies as to how much of this equipment is available. For example, a Soviet newspaper article concerning medical detachments from a large area of central Russia indicated that basic items of centrally procured equipment were missing from inventories, although simple, locally produced items were abundant. Civil defense equipment which is in common use during peacetime, such as firefighting equipment, trucks, bulldozers, cranes, and handtools, would be more readily available. In addition, heavy equipment available to civil defense regiments would offset shortages in civilian formations.

**27. The existence of organized civil defense formations** at Soviet industrial installations and other facilities, regardless of their state of training, provides some capability for postattack recovery, but their existence cannot always be assumed. For example, an inspection of a factory in Bryansk Oblast in 1974 revealed that, despite the presence of training plans, designated formation members, and reports on exercises, the factory actually had no effective civil defense organization. Workers in the workshop which had "won" the competition of civil defense formations for the previous two years did not know what their assignments were or, in the case of one squad leader, who the members of their teams were. Formation members assembled for tactical-specialized exercises

had been used to move fuel and raw materials. Although this factory is probably not the normal case, there are 16 reports from human sources of similar situations, in addition to the 61 reports in table III-1. For example, one source, who had been an engineer at a plant in Armenia, asserted that 80 percent of the plants in that republic lacked civil defense formations, including his own. A former resident of Leningrad reported that as of 1973 his institute, apart from appointing a part-time chief of the civil defense staff, had done nothing to organize the appropriate formations. An investigation by the city civil defense staff uncovered this fact and ordered the management to create formations and send the leaders to a week's training course. When the source left eight months later, however, the new formations were still largely inactive. It may be significant that none of these reports have dates of information later than 1975. A Soviet statement that a reorganization of the formations occurred in that year suggests that control over the formations has probably been tightened. Nevertheless, the reluctance of factory and other Soviet officials to divert manpower for civil defense probably has hampered the reform. The lag in our acquisition of information on the reorganization of the formations prevents our knowing how successful it may have been.

#### Training of Civilian Leaders

28. Since Altunin's appointment as Chief of Civil Defense, civil defense training has concentrated on preparing territorial and installation leaders for actions in a poststrike environment. The Soviet view of the importance of such training was expounded by the Deputy Chief of Civil Defense for Combat Training Lieutenant General V. Dyatlenko, in 1976 when he noted that:

Some leading civil defense workers who have not undergone training courses, especially at economic installations and in the districts, have proven incapable of effectively solving increasingly complex tasks or leading integrated installation-wide exercises....

29. Leadership training for civil defense occurs at so-called courses of civil defense, organized at district, city, oblast, republic, and national levels. These courses are intended for and normally restricted to civilian commanders of nonmilitary civil defense formations and above. As Altunin emphasized in 1973, the training focuses on practical activity. Normally lasting from five days to two weeks, the lower level courses typically end with a lengthy exercise. There is

a formal requirement for students who fail the final exercise to repeat the course.

30. As late as June 1976 the civil defense leadership was extremely dissatisfied with the operation of the courses. Open documentary sources noted, for example, that in one oblast the courses had stopped operating for three months, that in another only 48 percent of the students were in attendance on the day of inspection, and that poor attendance was a problem throughout the country. A human source reported that, in Leningrad, factory directors refuse permission for their employees to repeat the courses when they fail. While Dyatlenko's 1976 indictment doubtless began a campaign to improve the courses, its success is unknown. Furthermore, Soviet officials at lower levels often respond to pressure from above by collusion to conceal information from higher echelons. Pressures from above also result in actual improvements. Descriptions by individuals who have attended these courses indicate they leave much to be desired. In an exercise of the Moscow staff in early 1977, the performance of those involved was found unacceptable by city civil defense authorities.

31. Emphasis on practical activity and the subsequent participation of leadership personnel in command exercises and "integrated installation" exercises are positive features of Soviet training for civil defense cadres. The Soviet practice of designating as low-echelon leaders those persons already in authority in peacetime takes advantage of existing skills and habitual patterns of authority at the local level. Overall, the evidence suggests that the leadership training program has not been very effective.

#### B. Command and Control

32. Our evidence indicates that civil defense command, control, and communications facilities follow the military pattern: alternate command, control, and communications facilities within hardened or dispersed command posts. We expect the national civil defense communications systems will continue to emphasize redundancy and hardened communications facilities as a key to their survivability.

33. Communications requirements for alerting civil defense leaders across the country have been established. During the period following an attack a large volume of communications would be required to assess the damage sustained and to direct postattack civil defense operations. However, it appears likely that the

Soviets could maintain or quickly restore at least the most essential communications links. We have not analyzed the ability of the surviving Soviet communications system to support the long-term operation of the government and the recovery of the national economy.

34. In wartime, the military district commanders would apparently assume direct control of all civil defense activities through their deputies for civil defense. This role for the military districts suggests that under overall political guidance from Moscow, the military would administer all the essential activities in the Soviet Union immediately before and after a nuclear attack. Evidence of the operation of civil defense staffs in exercises suggests that civilian governmental authorities would continue to function but under military control. The designation of the peacetime head of each Soviet organization as the "chief of civil defense" also suggests that during wartime the administrative and governmental structure would become part of a civil defense chain of command. Furthermore, the 1977 textbook stipulates that the directors of installations are under the operational control for civil defense purposes of local authorities.<sup>6</sup> However, the wartime role of civil defense authorities in two republics whose territories contain more than one military district—that is, the civil defense staffs of the Ukrainian and Russian republics—is unclear.

35. The civil defense organization is supported by dedicated communications networks which are reported to link the civil defense headquarters in Moscow with major territorial headquarters throughout the USSR. Available evidence indicates that the communications centers of at least republic and oblast civil defense headquarters are manned by military communications units. Human sources report that the personnel in these units receive their signals training in units subordinate to various civil defense troop headquarters before assignment to units deployed near the major communications centers of the territorial staffs. We estimate, on the basis of firmly reported figures for the Armenian and Lithuanian republics, that some 900 communications personnel in this category operate the communication centers in the republics. The facilities of these centers would be used to transmit warning messages to subordinate territorial staffs and to control reconnaissance and rescue operations following a nuclear attack.

<sup>6</sup> Yegorov *et al.*, op. cit., p. 17.

36. The civil defense communications centers in the republics have been located some distance from the administrative civil defense headquarters of the locality. Their emergency communications facilities are in underground command posts. Reports from human sources and other intelligence data indicate that these centers possess, in addition to dedicated radio facilities, landline capabilities which in some cases are reported to afford them direct access to military commands other than the military district. It is likely, in view of stockpiles of military R-series radio equipment (some van-mounted) reported to be in the "untouchable reserve" category at these centers, that projected requirements for short- and medium-range tactical support for local emergency operations can be met.

37. In addition to this communications structure, human sources have regularly reported the presence of radio and landline communications in industrial shelters and at relocation sites and alternate command posts for industries. These communications connect plants that would continue to operate during a war with the territorial civil defense staffs and through them to the national command authority. Thus the Soviet Union possesses an integrated wartime communications structure, comparable to that of the military, from the top civilian authority to the industrial firm.

#### C. Manpower

38. The current estimate of full-time military and civilian civil defense personnel is about 117,000<sup>7</sup> which more than doubles last year's estimate. Last year's estimate of civil defense manpower was expressed as a minimum figure, because full-time civil defense personnel associated with schools and economic installations were not included. In addition, the number of people in staff organizations and military units is now believed larger than was estimated last year. It is emphasized that this year's higher figure does not represent a real increase in manpower. Rather, it is a reevaluation of our earlier estimates. Our best judgment on the trend in manpower is that total Soviet manpower devoted full time to civil defense has grown about 5 percent since 1968. (See table III-2.)

##### Staff Organizations

39. Our estimate of the number of personnel in the civil defense staff organizations has increased from about 16,000 to about 41,000. This is accounted for in

<sup>7</sup> See annex A for methodology of manpower estimate.

Table III-2

	Military	Civilian	Total
<b>Staff organizations</b>			
National .....	250	50	300
Republic .....	2,250	450	2,700
Oblast .....	4,600	4,600	9,200
City .....	1,660	11,130	12,790
Rayon .....	1,080	15,100	16,180
<b>Total .....</b>	<b>9,840</b>	<b>21,330</b>	<b>41,170</b>
<b>Military units</b>			
Military districts .....	400	80	480
Civil defense troops units	26,500	—	26,500
Communications troops .....	900	—	900
Military academy .....	400	—	400
<b>Total .....</b>	<b>28,200</b>	<b>80</b>	<b>28,280</b>
<b>Nomilitary organizations</b>			
Factories .....	—	33,500	33,500
Scientific institutes .....	—	2,700	2,700
Schools .....	3,000	2,700	5,700
Coop and public organizations .....	—	2,100	2,100
Housing and public utilities .....	—	3,500	3,500
<b>Total .....</b>	<b>3,000</b>	<b>44,500</b>	<b>47,500</b>
<b>Total civil defense personnel .....</b>	<b>41,040</b>	<b>75,910</b>	<b>116,950</b>

part by the 20-percent across-the-board increase at each level to cover support and administrative personnel. In addition, recent human-source reporting has provided a much better basis for judging the size and composition of territorial staffs, particularly at the city and rayon levels.

#### Military Units

40. The increase in manpower serving in the military units or organizations of the civil defense system is due primarily to increases in the numbers of civil defense regiments identified, and improvements in our understanding of their staffing. Table III-3 now lists 36 regiments compared with the 26 carried in 1976 (see figure III-3). Thus we have increased the strength of these units from 17,000 to 26,500. Additional personnel are assigned to military district staffs, communications units, and military academies, bringing the total estimate of military manpower to 28,200. This is a conservative estimate since it does not include additional regiments that we are reasonably certain are in existence but which we have not yet identified. Human sources with previous service in these units consistently state that civil defense troop

Table III-3

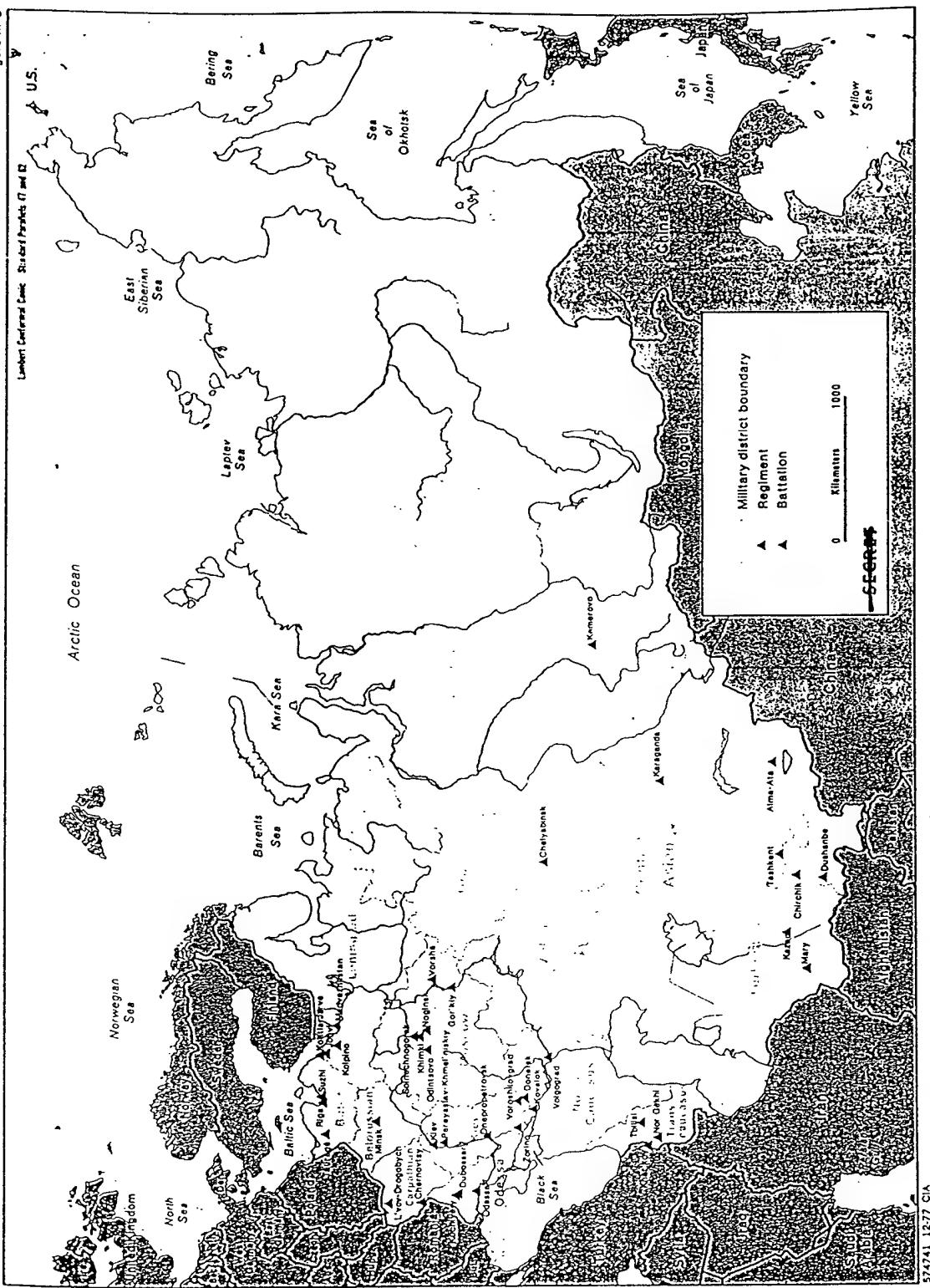
Regiments	Location
L'vov-Drogobych	Ukraine
Volgograd	RSFSR
Taurage	Lithuania
Chirchik	Uzbek
Leningrad (2 regiments)	RSFSR
Sosnovo	
Kolpino	
Vorsha	RSFSR
Minsk	Belorussia
Moscow (4 regiments)	RSFSR
Khimki	
Noginsk	
Solnechnogorsk	
Odintsovo	
Khar'kov	Ukraine
Dnepropetrovsk	Ukraine
Donetsk	Ukraine
Kohtla-Jarve	Estonia
Odessa	Ukraine
Riga	Latvia
Kazan'	RSFSR
Chelyabinsk	RSFSR
Voroshilovgrad	Ukraine
Kemerovo	RSFSR
Zorino	RSFSR
Tbilisi	Georgia
Kiev	Ukraine
Nor Gekhi	Armenia
Johvi	Estonia
Suzhi	Latvia
Karaganda	Kazak
Tashkent	Uzbek
Gor'kiy	RSFSR
Alma-Alta	Kazak
Dushanbe	Tadzhik
Mary	Turkmen SSR
Kovalok	RSFSR
Pereyaslav-Khmel'niskiy	Ukraine
Battalions	Military Districts
Chernovtsy	Carpathian
Dubossary	Odessa
Kuchiyery	Odessa

units are found near all significant industrial or politico-administrative centers.

41. Furthermore, this estimate does not reflect the wartime strength of the civil defense regiments. Information obtained over the past year confirmed that existing civil defense troop units would be expanded in wartime through assignment of reservists. Most reports indicate that the units would be upgraded to the next higher echelon and be augmented accordingly.

Identified Civil Defense Units in the USSR

Figure III-3



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#### Nonmilitary Organizations

42. By far the most significant change in our manpower estimates arises from inclusion of full-time members of civil defense staffs at individual economic installations, educational institutions, and other elements of Soviet society. Whereas in the 1976 IIM no effort was made to quantify this aspect of civil defense manpower because of lack of data, new information and analysis now permit us to estimate the numbers of people involved full-time at the installation level. The figures for this category contained in table III-2 are based on the size of a given facility and the regulations governing the appointment of a full-time chief of civil defense staff, plus assistants as appropriate. For example, analysis of available data indicates there is at least one full-time civil defense worker at factories having between 300 and 1,000 employees, whereas plants with more than 10,000 employees would have 10 full-time civil defense employees. The nearly 50,000 factories in the USSR were divided into categories according to work force size. Using this base, we arrived at a figure of 33,500 full-time civil defense workers in factories, or a ratio of one civil defense worker per 1,000 industrial workers. This same ratio, which is consistent with human-source reporting, was applied to institutes and other installations and provided an additional 14,000, for 47,500 full-time civil defense workers.

#### D. Costs

43. As explained in last year's IIM, the US Intelligence Community does not have precise estimates of the costs of Soviet civil defense. The USSR regards civil defense costs as classified information; therefore, only very fragmentary financial data on civil defense appear in published budgetary data. Moreover, according to Soviet decree, financing of civil defense is from republic or local budgets and from administrative and operating funds of self-supporting enterprises and organizations.

44. In the absence of budgetary data on civil defense, this year we have estimated the cost of three major elements of the Soviet civil defense program: namely, civilian and military manpower, operation of military units, and shelter construction. In addition to methodological uncertainties in our cost calculations, the accuracy of our estimates would be most affected by uncertainties in the estimates of civil defense manpower and the extrapolations by which estimates were made of the Soviet shelter program nationwide. While we believe manpower and shelter construction account

for the bulk of the costs of the program, we were unable to cost other items such as stockpiles of strategic reserves or dispersal and hardening of industries. If such programs exist on a national basis as part of the civil defense program, substantial additional costs would be involved.

#### Costing Method

45. The methodology used to develop these estimates involves identifying and describing programs and activities in detail and applying appropriate prices to them. The estimated costs—expressed in both rubles and dollars—are stated in constant prices. This is done so that changes over time will reflect only variations in the activities themselves and not in the price levels, and to facilitate comparisons with other economic aggregates. The ruble costs are expressed in 1970 prices and the dollar costs in 1976 prices. The ruble estimates are expressions of the costs as the Soviets are likely to perceive them. They should be used to assess the internal composition of the costs (for example, costs of manpower compared with shelter construction) and their relationship to other economic aggregates such as total defense spending. The estimates of the costs of the program expressed in dollar terms show what it would cost in the United States to duplicate the Soviet program and activities using their manning levels and construction practices. These costs provide an appreciation of the magnitude of the Soviet program in familiar terms.

#### Manpower Costs

46. The effort to estimate manpower associated with Soviet civil defense is limited by the body of information available. The estimate which has been developed, about 117,000 full-time workers in mid-1976, is subject to some uncertainty. This estimate includes both military and civilian personnel in governmental staff organizations, military units, and other organizations.

47. Estimates of Soviet civil defense personnel costs include expenditures for pay, allowances, and food for military personnel and wages of civilian civil defense workers. Military personnel in Soviet civil defense units were assigned the average ruble pay and allowances and food rates estimated to apply to personnel in cadre motorized rifle divisions. Military personnel at civil defense staffs and at schools were assigned military ranks and were compensated according to Soviet practice for paying men of these ranks. Ruble pay rates for full-time civilian workers in civil

defense were developed from the 1970 *Narodnoye khozyaystvo SSSR (USSR National Economy)*. Civilians employed at factories, schools, scientific institutes, public utilities, and other enterprises where full-time civil defense workers are found were estimated to receive average pay rates for workers at these organizations. The use of these average wages is supported by human-source reporting.

48. The total personnel costs for the civil defense program expressed in rubles are about 170 million rubles for 1976. The personnel costs and the manpower level are only about 5 percent greater than in 1968. To assess the cost in the United States of duplicating the Soviet programs, dollar pay and allowance factors were applied to these same personnel levels, ranks, and positions. For military units, the average 1976 rates of personnel compensation and benefits for active-duty US Army and Marine Corps personnel were used. Total pay for civilians serving on Soviet civil defense staffs was estimated by assigning US Civil Service grades and pay scales to them. Soviet civilian civil defense workers in industries and public service organizations were assigned pay rates of US manufacturing, public utility, and transportation employees. This results in costs of about \$1.4 billion for 1976.

#### Operation of Military Units

49. All military civil defense units are assumed to have been fully equipped since their deployment in the 1960s. The only costs logically associated with them, therefore, are for replacement of expendable items, normal replacement of equipment, and standard costs for spare parts, fuel, and other maintenance items. The same generalized cost factors developed to cover these activities for other army units in the estimates of Soviet defense costs were used here and appear to be reasonable approximations. The result is an annual cost of about 40 million rubles.

#### Construction Costs

50. The cost of construction for each type of civil defense shelter described in this report was estimated according to its design type using dimensional data from photographic interpretation reports and "estimate costs" (in rubles) which are published in an extensive series of Soviet handbooks. These handbooks provide factors for every aspect of construction. We increased these "estimate costs" from Soviet handbooks by 20 percent to adjust for the fact that these factors routinely underestimate actual costs of Soviet

construction. There is good evidence to support this adjustment factor from numerous Soviet sources.

51. The ruble cost estimates are then converted into dollars with dollar-ruble ratios developed from a large body of US and Soviet cost data. The dollar-ruble ratios developed through this methodology have been checked by costing selected US construction projects directly using Soviet cost factors. This validation process has heightened our confidence in the dollar-ruble price relationship developed for Soviet construction activity.

52. For costing purposes, data on Soviet civil defense shelter construction were drawn from the surveys made of industrial facilities and urban areas and extrapolations described elsewhere in this IIM. This approach provides an estimate of 2.9 billion rubles for the entire program, some 1.7 billion of which was expended in the period 1968-76. When expressed in dollar terms this figure amounts to \$7.0 billion for the entire program and some \$4.2 billion for the 1968-76 period.

#### Total Costs

53. Our cost estimates (see table III-4) are the product of the first attempt to cost elements of the Soviet civil defense program in some detail and should therefore be considered as rough approximations and not precise estimates. Much additional work needs to

Table III-4  
Costs of Soviet Civil Defense  
Manpower, Operation of Military Units, and Shelter  
Construction\*

	Ruble Costs at 1970 Prices (Billions)		
	Before 1968	Total 1968-76	1976
Manpower.....	—	1.51	0.17
Operation of military units .....	—	0.35	0.04
Shelter construction .....	1.16	1.70	0.19
Total .....	1.16	3.56	0.40

	Dollar Costs at 1976 Prices (Billions)		
	Before 1968	Total 1968-76	1976
Manpower.....	—	12.20	1.39
Operation of military units .....	—	0.83	0.09
Shelter construction .....	2.80	4.20	0.47
Total .....	2.80	17.23	1.95

\*These estimates should be considered rough approximations because they are affected by uncertainties both in the quantitative data on civil defense programs and in estimates of prices.

be done in order to increase our confidence in the estimates.

54. Manpower costs and the costs of operating the military units currently amounts to a total of slightly more than 200 million rubles per year. The cost of shelter construction for the entire period 1968-76 amounted to an estimated 1.7 billion rubles, or an average of 190 million rubles per year. This total of 400 million rubles represents less than 1 percent of estimated Soviet defense spending—between 57 billion and 62 billion rubles for 1976.

55. When these programs and activities are expressed in terms of US cost, it is the high US manpower cost which drives the estimate upwards. These costs amount to roughly \$1.4 billion per year. Construction costs add an average of \$470 million a year. These figures result simply from the fact that wages are much higher in the United States relative to construction costs than in the USSR. The dollar costs do help gain an appreciation of the magnitude of the program, but the ruble values are the only useful measure from the Soviet point of view.

#### E. Effectiveness of the Soviet Organizational Structure

56. Studies prepared under contract to the Defense Civil Preparedness Agency (DCPA) have established organizational criteria for determining effectiveness of disaster relief in the United States by studying responses to natural and other disasters.<sup>8</sup> Although the transferability of the results of these studies across cultural boundaries and to a different political system adds uncertainties, we believe that the criteria in the DCPA studies can be used to elucidate the effectiveness of the Soviet civil defense organization if cultural and political differences are taken into account. Moreover, many of DCPA's findings parallel the results of Soviet studies, as discussed in their writings on civil defense. These results emphasize the value of the following:

- Planning and research.
- Communications and dissemination of information.
- Suitability of organizational structure.
- Accurate beliefs about human behavior in disasters.

<sup>8</sup> These studies are summarized in "A Perspective on Disaster Planning," Disaster Research Center Report, Ohio State University, Series 11, 1972.

57. The data for evaluating the Soviet organization against these criteria come from the examination of civil defense organization, and from fragmentary reports of the Soviet civil defense program's responses to natural disasters and industrial accidents.

#### Planning and Research

58. The DCPA studies consistently emphasize the value of planning and supporting research in improving disaster responses. At the same time, they warn that highly detailed legalistic plans are likely to be difficult to implement in an emergency. The Soviet civil defense organization plans extensively, and strives to continuously update its plans and achieve realism. The rigidity and degree of detail which characterize Soviet military and civilian civil defense planning, however, could be a negative factor in the wartime effectiveness of the civil defense organization.

59. According to the DCPA studies, it is not only necessary to plan well, but also to persuade both the public and officials outside the planning process to accept the plans. If this educational effort does not succeed in producing public confidence in civil defense authorities, the plan will be implemented with reduced effectiveness. The skepticism of much of the Soviet public toward civil defense, and the reluctance of some national and local industrial officials, might have a negative effect on the implementation of civil defense plans. On the other hand, on the basis of studies of popular behavior during crisis situations and confirmed by human sources, we believe that the Soviet population would follow the instructions of civil defense officials in the event of a nuclear attack.

#### Communications

60. Rapid communications and dissemination of accurate information to civil defense task organizations and to the public are vitally important in disaster response. The Soviets recognize this requirement and have established the necessary communications infrastructure. Keeping the population informed of the progress of a disaster to encourage willing compliance with instructions may be less important in Soviet society, where coercive means of ensuring compliance are better developed and more readily used. The Soviets, however, have used all media and the telephone system to keep the public informed during past natural disasters.

#### Suitability of the Organizational Structure

61. DCPA studies stress the requirement that there be a suitable organizational structure for effective

control of operations during and after a disaster. The planned wartime structure of the Soviet civil defense organization would appear to satisfy this requirement. The peacetime effectiveness of the civil defense organization suffers from the fact that it must share control and supervision over most of the operating elements whose actions are essential in making preparations according to civil defense plans. In disaster recovery operations in wartime, however, civilian officials and the population likely would accept the centralized control of the military districts, and respond to military direction at lower levels of organization.

Beliefs About Disaster Behavior

62. The beliefs of the leadership about the likely behavior of the population during a disaster affect peacetime civil defense preparations, perceptions of the likely effectiveness of those preparations, and the conduct of wartime operations. The Soviets are clearly concerned about population behavior in an emergency, and place great importance on psychological conditioning in training and indoctrination programs to persuade people that survival in nuclear war is possible and to improve discipline and performance.

## Chapter IV

### PROTECTION OF THE LEADERSHIP

1. The Soviets have an extensive program for the protection of the national leadership and of key party, government, and economic personnel down to local levels, for the purpose of maintaining the continuity of the Soviet system during a period of nuclear conflict. The program consists of a system of in-town shelters and alternate command posts in exurban and rural areas designed to provide protection against nuclear, chemical, and biological attack. Emergency operations of the party, government, and civil defense forces would be directed from these command post shelters.

2. We believe that the program to protect the top national political and military leadership is independent of the civil defense program. This is evident in the program to harden military command and control facilities and to provide KGB protection and communications support for the top civilian leadership. When we speak of measures for the protection of the leadership in this paper, we refer not only to the top leadership, but also to some 5,000 party, government, and ministry officials at the national and republic level. In addition, we include party and government leaders at kray, oblast, city, and urban rayon level. The peacetime size of party and governmental elements varies at each of these echelons depending on the importance of the geographic area. Here we are concerned with those key individuals at each echelon whose functions are essential to operations of civil defense. They include chairmen of local soviets, their deputies and the heads of vital directorates and departments such as the KGB, militia (police), health services, and utilities. To this group of approximately 63,000 we have added some 2,000 managers of key economic installations as well as some 40,000 full-time civil defense staff personnel. We estimate that some 110,000 individuals make up the leadership essential to postattack operations.

3. The degree of planning and level of resources allocated to protecting this leadership are indicative of Soviet concern about maintaining control of the national activities in a postattack period. What portion of the leadership survives would depend in part on US

knowledge of its wartime locations and US targeting policies and practices. However, we have only limited knowledge of such wartime locations especially for leaders below the national level. The ability of surviving civilian and military leaders to direct postattack operations would depend, among other things, upon the means of communications and upon the effectiveness of plans for alternate authorities to assume control should control by primary headquarters be lost. We have few details about such contingency planning.

4. We are unable to judge Soviet longer term prospects with respect to the effectiveness of the leadership or other post-nuclear-attack capabilities. The Soviets themselves are probably uncertain about whether the present program would ensure the continuity of government operations and Communist Party control over the longer term. The continuity of Soviet government beyond the period immediately following a nuclear attack would depend upon factors which are largely unknowable, such as the effectiveness of the military in postattack recovery operations, leadership succession, the impact of ethnic separatism, and the overall progress in recovery and reconstitution.

#### A. Shelters

5. Many shelters for the protection of the leadership at all levels above have been constructed since the late 1960s. There are indications, however, that a program for leadership protection was under way as early as the mid-1950s and construction of shelters for the leadership is continuing.

##### Number, Type, and Location<sup>1</sup>

6. On the basis of recent intelligence, we have been able to confirm the existence of a pattern of structures for the protection of leadership in areas beyond Moscow. This pattern consists of hardened in-town

<sup>1</sup> The figures presented in this section appear in chapter VI as part of the aggregate total for shelters in urban areas.

shelters, matched by alternate command posts and facilities at relocation areas outside the cities. (See figure IV-1.)

7. Human sources frequently report on the existence of in-town shelters, many of them underground, multistoried structures, for national, republic, oblast, city, and rayon government and administrative leaders. These shelters have communications equipment installed and are reported to be well stocked with food, water, and other supplies.

8. We are unable to quantify on the basis of direct evidence the total number of shelter spaces for the leadership in urban areas. The pattern so far revealed of a large number of shelters in and around government facilities reflects Soviet capability to shelter key party and government workers with minimum warning.

9. The subway systems in many major cities play an important role in providing urban shelters for leadership cadres. Many sources have reported that the multilevel shelters within urban areas as described above are connected directly with the subways, thus affording additional protected access to the shelters. (See chapter VI, section A.)

10. The Soviets have constructed elaborate alternate bunkered command and control facilities for use by top civilian authorities at national, ministerial, republic, and oblast levels.

There are at least two relocation sites around Moscow for the top national political and military leadership—Chekhov and Sharapovo. A third, Chadayevka, is located near Penza, 648 kilometers southeast of Moscow.

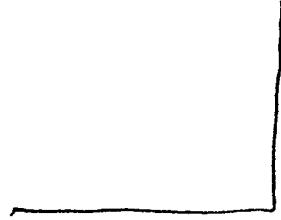
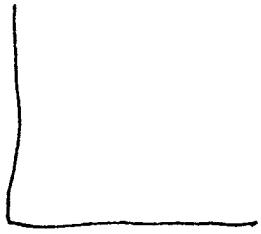
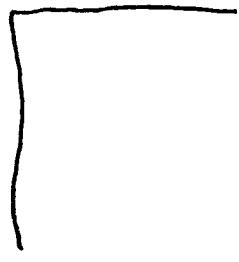
11. At least four ministries<sup>2</sup> have been reported to have relocation sites around Moscow.

Some of these facilities are examples of the Soviet "dual purpose" concept, whereby installations which serve a civil defense function in wartime have other uses in peacetime, such as schools and rest homes.

<sup>2</sup> Power and Electrification, Gas Industry, Radio Industry, and Nonferrous Metallurgy.

12. At the republic and oblast levels, relocation sites have also been provided for party and government

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leaders and civil defense cadres. The alternate command post for [ ]

[ ] for example, is a multilevel installation containing the support and communications facilities needed to direct wartime civil defense operations. Similar republic-level command posts have been identified elsewhere. This description also fits the Leningrad Oblast alternate command post for civil defense. At these command posts civil defense troops provide communication links with other civil defense headquarters within the republic or oblast and with the military district headquarters.

13. [ ]

[ ] We believe that such facilities are available for at least the leadership of [ ] republics and major oblast centers. In addition, there have been reports that cities with a population between 100,000 and 1 million also have alternate command posts.

14. For the economic and industrial leadership of urban areas, command post shelters have reportedly been located 20 to 40 kilometers outside the city. These shelters reportedly contain communications equipment to maintain control over ongoing operations in the installations in urban areas. Human sources from Kiev and Leningrad, with backgrounds in design of communications systems, have confirmed the existence of this type of shelter.

Capacities<sup>3</sup>

15. In-town shelters for the leadership vary widely in size. The size of shelter complexes varies with the importance and function of the installation served. For example, [ ]

16. [ ]

<sup>3</sup> Shelters analyzed in this section do not include those at economic installations which would be available for the economic/industrial leadership.

[ ] total shelter floorspace in alternate command posts near Moscow and at Chaadayevka is about 139,000 square meters.

17. [ ]

[ ] 18. In determining the capacity of these shelters, we have used US planning factors because we lack information on how much of the shelter floorspace will be taken up by equipment. The US factors allow as much as 10 square meters of floorspace per person at national and regional command posts, including space for equipment, supplies, and furnishings. Since floorspace requirements at lower levels could be much lower given the smaller magnitude of the effort in such jurisdictions, we have allowed 5 square meters per person. On this basis, shelters in town and in exurban areas for which sufficiently precise data exist to permit measurement, add up to about 205,000 square meters. On the basis of 10 and 5 square meters per person, they could accommodate between 21,000 and 41,000 people. This represents only those shelters that have been identified and whose sizes have been estimated. Roughly an equal number have been identified whose sizes cannot be estimated. If we were to apply the same calculations to those shelters whose sizes have not been estimated, the total would be doubled. Since we have examined only a small portion of all the cities in the Soviet Union, the overall total would be much greater. From the evidence available we conclude that the majority of the leadership elements could be accommodated in shelters prior to an attack if several hours' warning time were available.

19. *Hardness*. The shelters available for the top national leadership, those at Sharapovo, Chekhov, and Chaadayevka, are estimated to be the hardest. Our best estimate of shelter hardness ranges from about

We have not been able to calculate the hardness of alternate command posts at the republic and oblast levels. The built-in or detached shelters available to the leadership in town have been assessed as being 350 to 1,030 kPa (50 to 150 psi) hard, which is the same hardness we estimate for other shelters of these types. (See chapter V, section A for an explanation of how these hardness values were derived.)

20. Leadership shelters within urban areas and those at alternate sites would also provide a high degree of personnel protection against such nuclear weapons effects as initial nuclear and thermal radiation. Adequate information on electromagnetic pulse (EMP) protection is lacking.

#### Supplies and Equipment

21. Human sources have reported that shelters in urban areas and at relocation sites have adequate stockpiles of food, medicine, protective equipment, communications, and other supplies for their prospective occupants. The exact level of supplies is not known.

#### B. Warning, Relocation, and Exercises

22. Within minutes after warning that a nuclear attack was under way, many in the leadership could take shelter in available detached and basement shelters in urban areas near their headquarters or in other available shelters, including subways. If the Soviets believed an attack would not come for several hours or more, a large portion of the leadership at all levels would probably evacuate to relocation sites and bunkered shelters in rural areas. With a longer period for final preparations or as a precautionary move a portion of the leadership could be relocated prior to the notification and evacuation of the general

<sup>1</sup>The dynamic response of a target is dependent on the applied impulse, which is a function of both the magnitude and duration of the applied load.

Thus, a larger weapon will deliver a given impulse load to a target at a lower pressure than will be delivered by a smaller weapon.

population. Most of the relocation sites for the high-level leadership are within an hour of Moscow and other major cities by car. Subways and other transportation resources would be available on a priority basis to facilitate the relocation process. Below the national level, a portion of the leadership probably would be sheltered in cities to direct the civil defense efforts.

23. Since the late 1960s there have been numerous references from all sources to civil defense exercises at all administrative levels in which high-level officials participated. Exercises have included such activities as evacuation to relocation sites and practicing operational roles under simulated conditions. These exercises served to detect weaknesses in the leadership protection program, to familiarize Soviet leaders with their responsibilities, and to build confidence in their ability to react effectively in a crisis situation.

24. Emergency relocation procedures are known to have been tested recently for some key ministerial officials at the national level. Evidently the Soviets see a continuing requirement for leadership participation in civil defense exercises, and civil defense officials have expressed a need for increasing the number of practical exercises at oblast, city, and rayon level.

C. Program Effectiveness

25. Although the Soviets have constructed many shelters for the leadership in major cities and at relocation sites in rural areas, those shelters which have been identified are vulnerable to direct attack. Such shelters would provide effective protection only in the event that these facilities were not directly targeted by the United States

Considering the number of shelters likely to be available to protect the leadership at all levels and the communications support for civil defense, we estimate that with several hours to make final preparations a large percentage of leaders and communications facilities would survive a large-scale nuclear attack.

## Chapter V

### PROTECTION OF THE ECONOMY

1. The Soviets' civil defense plans and programs for protection of the economy, as reflected in their publications and reporting from intelligence sources, encompass several complementary measures. They include geographic dispersal of industry, sheltering and dispersal of essential personnel, relocation of certain installations or equipment to exurban zones where operations will continue, the physical hardening of some facilities using permanent construction techniques, hasty hardening measures, and rapid shutdown procedures.

2. The way in which any combination of these procedures is implemented depends on the civil defense category to which a given economic installation belongs. Such classification has been a key element of all Soviet civil defense plans since 1961,<sup>1</sup> and relates both to the installations themselves and the areas in which they are located. This categorization of enterprises probably explains the variations we have observed in such things as shelter allocation or the degree of hardening at economic installations. We are now beginning to acquire some information on the types of installations in each of the categories. Yet, our data base is still too limited to permit us to identify patterns of civil defense preparations at economic installations from which we could infer the types of industries and measures associated with the three categories. Confirmation that a categorization system

<sup>1</sup> The 1961 Resolution of the Central Committee and Council of Ministers of the USSR establishing the civil defense statute states "The scope and time limits for carrying out civil defense measures in towns and other centers of population are determined ... in accordance with their administrative-political, economic, and defensive significance. For this purpose large administrative centers and large industrial cities are divided into cities of the special 1st, 2nd, and 3rd groups for civil defense. The most important installations of the national economy are divided into installations of special importance and the 1st and 2nd category." The 1977 civil defense textbook and reliable human sources confirm the existence of categories for urban areas and individual installations and have provided some examples of how the application of this system determines the extent of civil defense measures.

is being used, however, should aid us in understanding how economic protection is practiced and may help in future analysis of data on this subject.

3. All sources indicate that the survival of a sufficient number of management personnel and skilled workers is the key factor in maintaining and restoring production after a nuclear strike. This emphasis has been confirmed by the large number of hardened shelters at economic installations identified in photography during the past year. Protection of personnel is also reflected in the reporting by numerous human sources who state that their places of employment have plans for dispersal or relocation.

4. While many sources have reported that the Soviets have employed special construction techniques such as the use of underground structures to protect production facilities, there has been limited confirmation in photography. We have a few reports of geographic dispersal of industry for civil defense purposes and preparations for hasty hardening measures. Rapid shutdown, which is emphasized in Soviet civil defense publications, has been reported by human sources as a key element of the civil defense procedures and training at their places of work.

5. While many sources refer to the existence of strategic reserves for industrial use as well as the needs of the population (see chapter VI, section C), we are still unable to develop evidence which would provide some indication of the magnitude of these reserves and any steps the Soviets have taken to protect them against nuclear effects.

6. In this chapter we report what we know about protection of personnel, dispersal, relocation, hardening, rapid shutdown of economic installations, and stockpiles of supplies and equipment. We have made no effort, however, to evaluate Soviet economic recovery capabilities in a postattack period. The effectiveness of Soviet programs for protection of the economy addressed herein provides an appreciation of the levels of industrial damage the Soviets may sustain

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in a full-scale retaliatory attack by the United States. It does not, however, provide an estimate of the overall Soviet ability to recover as a major economic and military power following a nuclear exchange or to support a protracted war.

#### A. Protection of Essential Personnel

7. In their programs to protect the economy, the Soviets have given first priority to protection of personnel at economic facilities. Their plans for protecting the work force are related directly to the importance of the place of work both in terms of its output and its contribution to postattack recovery. Some industries and other enterprises will continue to function on a two-shift basis, with one shift dispersed to exurban areas and the other protected in shelters at or near its installation. Employees of enterprises which will stop operations or are considered nonessential will be evacuated. In this section we have concentrated on protection for personnel at industrial facilities considered essential to defense production and postattack recovery.

8. The measures described for protection of personnel at these industries are also applicable to other economic installations. Civil defense equipment is available at these installations for personnel protection, rescue, first aid, and training. Information from all intelligence sources confirms that apart from leadership protection the Soviet program for protecting essential personnel has received the most emphasis.

#### Types of Shelter at Economic Facilities

9. The 1976 IIM on Soviet civil defense noted the decisions in the late 1960s by the USSR Civil Defense Headquarters and the State Committee for Construction (Gosstroy) stipulating that shelters be included in plans for all new buildings. Recent reporting from several sources with experience in the design and construction of industrial, administrative, and institutional facilities has provided further insight into these resolutions, the manner in which they are implemented, and the technical specifications used in adapting shelter designs to new construction. These sources all confirm the existence of standard shelter designs and requirements which are coordinated with the appropriate territorial civil defense staff. In particular, they have discussed the administrative procedures for implementing shelter construction and the manner in which civil defense staffs monitor this construction to ensure adherence to approved specifications. While none of these sources could provide the precise guidelines used by the civil defense staffs in allocating

shelters, they all believed that the requirement for the inclusion of shelters in new construction was most rigorously enforced. Detailed descriptions of individual shelters by these sources supported this contention and provided photographic signatures which greatly assisted analysts in their search for shelters.

10. These standard designs are of two basic types, detached and built-in. The latter, often referred to as "basement" shelters, are constructed as an integral part of new buildings or may extend from the foundation area of a structure into adjacent open areas. While they resemble basements in the early stages of construction, their actual specifications are geared to civil defense requirements for blast and fallout protection. Several human sources with experience in civil defense construction have stated that built-in shelters are the most common because construction costs are understandably lower. In addition to new basement shelter construction, these same sources report that older, pre-1968 basement shelters are being brought up to current civil defense standards, particularly with regard to life support systems. Detached shelters, on the other hand, are constructed in open areas such as courtyards and normally do not form an integral part of the surrounding buildings. In some cases, these are semidetached in that there are underground passageways which provide protected access to the shelters. Capacities of these standard shelters vary widely. Soviet literature categorizes shelter sizes as: small (up to 150 persons); medium (150 to 450); and large (over 450). Human sources and photography confirm these capacities and have identified large shelters which can accommodate 3,000 persons or more.

11. In an effort to reduce the cost of shelter construction, provisions are often made in the design for their use in peacetime as garages, classrooms, storage areas, or other purposes. Such dual use should not inhibit the use of the structure as a shelter. Human sources and photography confirm this practice. All of the foregoing pertaining to shelter design standards, construction methods, capacities, and dual use relate not only to shelters at economic facilities but to all shelters in urban areas.

#### Analysis of Shelter Programs at Selected Soviet Industries<sup>2</sup>

12. *Data Base.* As part of the effort described above, a detailed study was made of civil defense

<sup>2</sup> For details on the methodology of the analysis, see annex B.

measures at 150 Soviet industrial plants selected from 17 key recovery industries. In addition, 113 plants from five military-related industrial categories were examined.

13. *Limitations of the Data Base.* There are several limitations and restrictions on the use and interpretation of the data available for estimating the total number of shelters at economic facilities:

- Imprecision in the estimates of the available shelter area and the size of the work force to be protected limit the strength of the inferences to be drawn.

- The small number of plants sampled within each category lessens the degree of confidence that can be placed on the estimates of civil defense activity at all plants in these categories in the USSR.
- Some categories of the sampled plants are not representative of the totality of all such plants in the USSR.<sup>3</sup>
- Projections from the sampled plants can be made only for those key recovery industries included in the survey.

For some categories, listing is incomplete.

These limitations reduced the usable data base on industries considered to be key economic recovery categories from 17 to 10 and military-related categories from five to three.

14. *Percentage of Crisis Work Force Protected in Plants Surveyed.* Soviet plans do not call for sheltering the entire labor force. They plan to close nonessential industries entirely and to evacuate non-essential workers from those industries that are to continue production. The remaining essential work

<sup>3</sup> For example, a sample of only large plants in a particular category will bias any projections made to all such plants, if the size of a plant is related to the presence and level of civil defense activity.

force at each plant is to be divided into two shifts, one to be dispersed to locations within commuting distance of the enterprise, the other to continue work. We believe the shelters at economic facilities are intended for that portion of the essential labor force at work during a crisis—which we have designated the “crisis work force.” The size of the crisis work force would vary, but could be no more than 50 percent of the total labor force at some enterprises. If an occupancy factor<sup>4</sup> of 1 square meter or more per worker is applied, less than 8 percent of the plants (11 out of 150) surveyed could accommodate the entire crisis work force. At a factor of 0.5 square meter per worker, 21 percent of these plants (30 out of 150) could protect the total work force. Assuming a much smaller crisis work force, as many as 62 percent of the plants (87 out of 150) could shelter this crisis work force.

15. Combining all the key recovery industrial categories for which there is sufficient information—that is, 15 out of 17 categories—a minimum of 48 percent of all crisis workers would be sheltered at 0.5 square meter per worker; and a minimum of 24 percent, if the occupancy factor were 1 square meter per worker. These estimates do not take into consideration the unknown number of shelters within a reasonable distance from a plant. Estimates including such shelters would, of course, result in an increase in the above percentages.

16. *Comparison of Military and Key Recovery Industries With Shelters in the USSR.* Having surveyed 10 of the categories (see table V-3) we estimate that 46 percent of all plants in those categories in the USSR have at least one shelter with a total shelter area of 365,820 square meters. In the three military-related categories sampled completely (table V-2) 70 percent at the missile production plants, 53 percent at the ball-bearing plants, and 57 percent at the suspect biological warfare plants had shelters. Overall, the percentage of plants with shelters in those three military categories in the USSR was 67 percent.

<sup>4</sup> Shelter “occupancy factors” are based on the figures most often quoted by the Soviets in their publications or 0.5 square meter per person for the lower bound. The lower bound of 0.5 square meter is the minimum currently recommended by European nations which have had wartime experience and which have conducted occupancy tests at this allotment. The upper bound of 1 square meter is based on an average of space allocation figures provided by knowledgeable human sources; these range from 0.5 square meter to 2 square meters per person. These figures are consistent with DCPA studies which recommend 1 square meter as a desirable goal but allow 0.5 square meter as a practical minimum.

Table V-1

## Survey of 17 Key Soviet Recovery Industries

Category	No. of Plants Surveyed	No. of Plants <sup>1</sup> in USSR	Fraction of Total Capacity Sampled	Available Floorspace <sup>2</sup> (sq meters)	Area Per Worker <sup>3</sup>
Aluminum .....	5	14	.47	6,531	1.06
Bearings .....	5	19	.39	3,200	.17
Cement .....	15	96	.24	1,327	.20
Chemical .....	18	Unk	Unk	41,136	.78
Communications equipment ...	9	74	.27	5,602	.36
Computers .....	6	Unk	Unk	0	Unk
Electrical equipment .....	11	Unk	Unk	4,634	.13
Electrical power (w/o hydro) ..	10	410	.08	4,697	.43
Engines .....	5	12	.88	2,802	.12
Iron and steel .....	12	87	.51	23,595	.12
Machine tools .....	13	103	.28	1,186	.04
Motor vehicles .....	5	24	.32	46,938	.36
Nonferrous (w/o aluminum) ....	7	28	.45	1,570	.13
Pharmaceuticals .....	3	Unk	Unk	881	Unk
Petroleum .....	12	46	.38	5,790	.17
Synthetic rubber .....	4	14	.40	2,695	.29
Transportation (w/o motor vehicles) .....	10	Unk	Unk	9,285	.09
Total .....	150	927		161,869	.24

<sup>1</sup> We have allocated two-thirds of the total floorspace of shelters for personnel, since we know that roughly a third of the floorspace is taken by life support equipment and supplies.

<sup>2</sup> Calculated using estimated number of crisis workers.

Table V-2

## Survey of Five Soviet Military-Related Industries

Industry	No. of Plants Surveyed	No. of Plants <sup>1</sup> in USSR <sup>1</sup>	Fraction of Total Capacity Sampled	Available Floorspace <sup>2</sup> (sq meters)	Area Per Worker <sup>3</sup>
Missile production .....	77	77	1.0	Unk	Unk
Ball bearing .....	15	15	1.0	Unk	Unk
Chemical warfare (suspect) ....	6	Unk	Unk	10,447	1.55
Biological warfare (suspect) ...	7	7	1.0	3,108	Unk
Armor and motor vehicles .....	8	Unk	Unk	71,076	Unk
Total .....	113				

<sup>1</sup> We have allocated two-thirds of the total floorspace of shelters for personnel, since we know that roughly a third of the floorspace is taken by life support equipment and supplies.

<sup>2</sup> Calculated using estimated number of crisis workers.

Table V-3

Available Shelter Area and Estimate of Plants With At Least One Shelter for 10 Industrial Categories

Category	Population	Estimate of Shelter Area (sq m)			Estimate of Number of Plants With At Least One Shelter		
		90% Confidence Bounds			90% Confidence Bounds		
		Best	Lower	Upper	Best	Lower	Upper
Aluminum .....	all 14	13,911	6,499	24,597	8 (60%)	3	12
Bearings .....	all 19	8,160	3,184	15,107	11 (60%)	4	16
Cement .....	all 96	8,448	1,760	15,135	32 (33%)	12	61
Communication equipment .....	29 largest	27,076	3,716	50,700	18 (63%)	8	28
Iron and steel .....	22 largest	46,420	30,398	62,442	22 (100%)	18	22
Machine tools .....	all 103	10,221	1,186	27,475	16 (15%)	2	50
Motor vehicles .....	all 24	225,300	46,938	438,000	24 (100%)	12	24
Nonferrous .....	all 28	3,457	1,570	6,514	8 (29%)	2	19
Petroleum .....	all 46	15,120	5,762	27,880	27 (58%)	14	38
Synthetic rubber .....	all 14	7,707	5,313	10,100	14 (100%)	7	14
Total .....	395	365,820	150,000 <sup>1</sup>	582,000 <sup>1</sup>	180 (46%)	145 <sup>1</sup>	215 <sup>1</sup>

<sup>1</sup> Approximate 90-percent confidence bounds for the total (that is, not merely the sum of individual 90-percent confidence bounds).

a moderate but significant increase over the 46 percent for the key economic recovery categories.<sup>5</sup>

**17. Pace and Scope of Industrial Shelter Construction.** Data on 12 of the 17 industrial categories<sup>6</sup> were analyzed to determine the pace and scope of shelter construction. It was found that:

- Plants which were recently constructed or had been expanded since 1968 are more likely to have shelters than plants which have not expanded since 1968.
- About 80 percent of the plants with a major post-1968 expansion have at least one shelter; of plants without a major post-1968 expansion, only 45 percent have at least one shelter.
- More large plants have shelters than do smaller ones; 76 percent of the "large"<sup>7</sup> plants have at least one shelter, while only 40 percent of the smaller plants have at least one shelter.

<sup>5</sup> One of the more disturbing results of this analysis, however, is the large variance of the estimates. Often the upper 90-percent confidence bound is more than twice the projected USSR total. These confidence intervals reflect only the error due to sampling, not those due to misclassification or other sources. Thus, the true uncertainty is probably larger. Hence, most conclusions based on this sample should be considered tentative.

<sup>6</sup> Aluminum, bearings, cement, communications equipment, electric power (without hydro), engines, iron and steel, machine tools, motor vehicles, nonferrous metals (without aluminum), petroleum, and synthetic rubber.

<sup>7</sup> "Large" is defined as a plant whose capacity falls in the upper 25 percent [for its category.]

— Combining these two analyses, 89 percent of those plants that are "large" with post-1968 expansion have at least one shelter. Alternatively, only 25 percent of the plants that are small with no post-1968 expansion were found to have at least one shelter.

**18.** Two additional statistical analyses were conducted to determine if any differences in civil defense activity among industrial categories and across geographic regions of the USSR could be due to sampling error alone. Using total shelter area as the measure of civil defense activity, only the chemical industry had a significantly higher average shelter area. There did not appear to be any gross regional effect on civil defense activity at industrial plants.

**19.** In summary, the analyses of the data on Soviet industries indicate that within key economic recovery and military installations, there exists a broad and comprehensive civil defense shelter program. That portion of the crisis workers (50 percent of the total work force) who could be sheltered at 15 out of 17 key recovery industrial categories surveyed ranged from 24 to 48 percent.

#### Protection Afforded by Shelters

**20.** Soviet manuals state that shelters at economic enterprises in general are designed to sustain overpressures of 100 to 200 kilopascals (14 to 28 pounds per square inch). These are the design criteria ("sure safe" survival) applied by the Soviet construction industry.

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(The hardness values of 100 to 200 kPa [14 to 28 psi] do not apply to any particular weapon yield.) Technical analysis of these same shelters was conducted

These analyses indicated a range of 350 to 1,030 kPa (50 to 150 psi) for a 50-percent probability of severe structural damage. (These are estimates of blast resistance for two different Soviet designs.) Table V-4 and figure V-1 demonstrate the range of hardness estimates associated with the 1,030 kPa (150 psi) Soviet shelter. In addition to providing a moderate level of protection against blast, these shelters would also provide very good protection against other nuclear effects such as thermal and prompt radiation. The hardness levels attributed to these shelters assume that other shelter components such as doors and ventilation equipment are also designed and built to withstand blast and other prompt nuclear effects at a level at least equal to that of the structure itself.

21. Many kinds of blast closures to protect ventilation openings and entranceways have been designed and built since about 1950. Several countries besides the United States manufacture blast closures, and the state-of-the-art is considered to be excellent and well known to the Soviets. Numerous tests of closures have been conducted by the United States to overpressures in excess of 1,380 kPa (200 psi) in full-scale nuclear field tests, and no blast door failures were reported. The closures portrayed in Soviet manuals are much like those used in the United States and European countries, and there is no reason to believe that their closures have lesser capabilities than those which have been tested elsewhere.

22. Reports on stocking of these shelters present a mixed picture on the type and level of supplies and civil defense equipment. From many human-source

reports, it would appear that most shelters have been provided with at least water supplies and emergency medical kits, but are not normally prestocked with food. Some reports indicate that protective clothing, gas masks, and dosimeters were stored in these shelters, but others state that while such civil defense equipment was available it was generally stored elsewhere in the plant. If, as indicated, many of these shelters have not been prestocked with food, their adequacy to sustain the occupants would depend largely on the amount of time the Soviets have prior to an attack to complete the outfitting of shelters. Shelters are inspected periodically by territorial civil defense staffs, which could improve the overall level of preparations. Nevertheless, there are continuing reports of deficiencies in shelter readiness.

#### Dispersal of Essential Personnel

23. The 1977 Soviet civil defense textbook describes dispersal of essential personnel as follows:

Dispersal is the name given to the organized withdrawal and quartering of employees in an exurban zone for those enterprises and organizations which [will] continue to operate in the cities. . . . In the category of dispersed persons are also the employees of the installations which support the vital activities of a city (for example, utility workers).

Among the installations to be dispersed are those whose production lines will shift to wartime schedules, which will continue operations up to the time of attack in order to minimize loss of production, and which will attempt to resume operations as soon after an attack as possible.

24. The plan as described in the 1977 Soviet civil defense textbook is to resettle employees in the exurban zone or "outside the limits of the zones of possible destruction," yet close to roads or rail lines from which they can be transported to and from the city in a few hours. Available transport will be used to move personnel between the dispersal site and the city in order to provide for uninterrupted production at their enterprises.

25. Human sources have confirmed that such plans existed at their place of work, although many did not know the details. We also know of dispersal plans from references to exercises mentioned in the Soviet press and by human sources. Some sources have participated in dispersal exercises staged by their enterprises and have indicated that the level of preparation at these

sites was adequate—that is, there was housing and food available. Others have observed minimal preparations. Dispersal sites can be small towns and villages or special facilities such as rest centers operated by the enterprises and by other organizations. Most of the sites referred to by human sources have permanent structures, such as residential or administrative buildings, or have been provided with some type of expedient structures, such as tents or hasty shelters.

#### Other Protective Measures

26. Protective civil defense equipment such as gas masks and special clothing is reportedly available at many enterprises. In civil defense exercises at some

plants, workers have practiced donning their gas masks and clothing or operating other equipment such as dosimeters. Some sources, however, report that they were measured for protective equipment but that no equipment was subsequently provided. From human sources and other intelligence data we find that Soviet economic enterprises must acquire such equipment for their employees and include its cost in their civil defense budget.

27. We conclude that the individual protective equipment and supplies available depend on the civil defense priority category of the industrial facility and on the emphasis placed on civil defense by its director. Each industrial enterprise probably has at least a small

number of protective masks and suits for training and demonstration purposes, and many have sufficient equipment for those civil defense teams that have been organized. We are unable to estimate what percentage of the essential work force would have protective equipment available in an emergency. It is doubtful that the availability of individual protective gear would pose a serious problem in important economic installations, because most of this equipment consists of standard models manufactured for general military and industrial use.

#### Effectiveness

28. Calculations and estimates of shelter capability to withstand specific nuclear weapons effects are not the only measure of effectiveness of Soviet capabilities to protect essential personnel during the days and weeks following a nuclear attack. The adequacy of shelters in protecting the work force depends on such other factors as their equipment, facilities, and supplies. To date, our overall estimates of shelter capacity at industrial facilities indicate that at a minimum 24 to 48 percent of "crisis workers" could be accommodated in shelters. This is based on the arbitrary assumption that the crisis work force would comprise one-half the total work force. It is possible that in some instances all those on shift could be sheltered.

29. In any case, it is reasonable to assume that the Soviets would have to depend on the evacuation and dispersal of off-duty workers away from expected target areas. This assumption is consistent with Soviet statements that nuclear war would most likely occur in a period of rising tension during which the risk of a nuclear attack would be recognized. If it is assumed that shelter equipment and supplies are adequate, then the probability of survival of the critical work force would be a function of shelter hardness against prompt effects and fallout.

30. It is appropriate to consider worker survivability primarily as a function of shelter hardness against blast, because analysis indicates that if the shelter survived the blast it would also provide adequate protection from prompt radiation. [C]

[C] In a typical Soviet shelter located at these distances from the burst point the initial radiation within the shelter would range from 30 to 80 rads (see

figure V-2). The 30-rad level is below threshold of noticeable symptoms of radiation illness of 50 rads, while the 80-rad level is well below the 200-rad level which would result in illness to about 50 percent of those exposed. To calculate the overall radiation dose, fallout radiation that the shelter occupants may experience must be added to the prompt radiation. It is difficult to define with precision the fallout radiation environment. If the attack were at optimum height of burst to achieve structural damage to industrial facilities, the Soviet shelters would probably provide fallout protection adequate for survival of the occupants. If the attack utilized ground bursts, the radiation from fallout would be greater but determining the exact levels would require target analysis on a case-by-case basis.

31. Figures V-3 through V-6 depict the probability of the overall survivability of the work force. Figure V-3 presents the results of analyzing the probability of survival of workers in a given type of shelter at the time of an attack which is located essentially at the aim point of the factory. [C]

[C] Figures V-4, V-5, and V-6 present the probability of survival of workers actually in shelters at the time of an attack located at various distances from the weapon aim point.

32. A question now arises as to what shelter hardness might be required to provide a very high level of probability of survival for personnel in a shelter at a weapon aim point. This calculation has not been performed but it would be estimated that shelter hardness of about 7,000 kPa (1,000 psi) or greater would be required to provide such capability. The construction costs of such shelters would be substantially more than construction costs of the shelters studied here. Considering the overall probability of survival of the work force as presented in figure V-3, this may not be a reasonable or wise expenditure of resources.

33. In general, there are many uncertainties associated with the overall effectiveness of shelters at industrial enterprises. For example:

— The adequacy of equipment such as doors, ventilation systems and sanitary facilities needs to be analyzed further. The equipment described in Soviet manuals and by knowledgeable human sources appears to be technically capable of meeting minimum survival requirements. Some

reports, however, indicate that necessary equipment in some shelters was either missing or in poor condition.

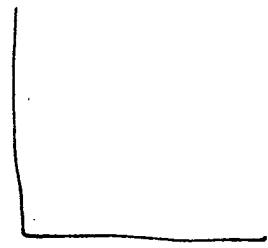
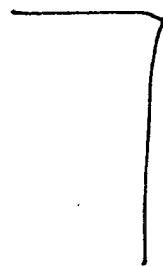
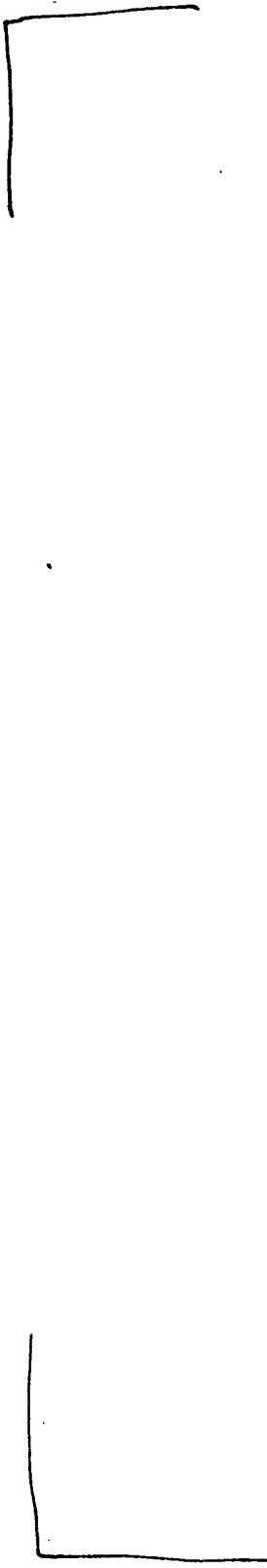
— The habitability of these shelters is scenario dependent and is a function of the level of supplies and the number of people who would occupy these shelters. With adequate warning, supplies and equipment could be provided and nonessential personnel would be evacuated. Without sufficient warning it would be difficult to carry out preparations and maintenance activities, and the number of workers to be sheltered could exceed available capacity.

34. If the preparations described above were in fact carried out during a period of tension prior to an

attack, then shelters at industrial enterprises would be highly effective in reducing the number of total fatalities among workers at these installations to very low levels. In the absence of these preparations, available shelter capacity and the length of time these shelters could be occupied would be reduced, but we are unable to estimate what impact this may have in terms of the increased number of fatalities and injuries which would occur. The radiation environment generated under various attack assumptions could require a shelter stay in some areas which could last as long as two weeks.

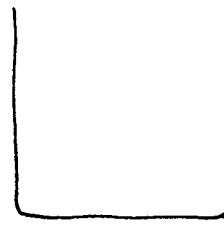
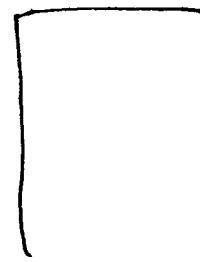
35. As mentioned above, workers at industrial enterprises could be dispersed to exurban areas in one or two days following the initiation of a special period.

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Their dispersal alone from major urban areas could reduce the number of fatalities and injuries by half or more. If fallout protection were also provided, the number of fatalities could be reduced to low levels.

### B. Geographic Dispersal of Industry

36. Most recent Soviet plans continue to call for the dispersal of industry on several levels.

- National Dispersal: A long-term, evolutionary program to build new industrial plants, complexes, and associated towns in areas of low industrial concentration, aimed at equalizing productive capacity of the various economic regions of the USSR.
- Regional Dispersal: The concept of limiting growth in old, established industrial centers by siting new production facilities in exurban areas within a region. Regional dispersal is often characterized by the presence in a given region of a large plant, such as a motor vehicle assembly plant, supported by small, highly specialized enterprises which are geographically dispersed in small towns as well as in urban settlements.
- Urban Dispersal: Locating new plants in lesser developed parts of urban areas and siting new buildings and storage areas away from existing ones within plant perimeters to reduce the collateral effects of a nuclear strike.

### Soviet Economic Development

37. Development of industry in remote areas of the USSR has historically been one of the goals expressed in Soviet economic doctrine. In the last 20 years the need to reduce congestion in urban industrialized areas by restricting construction of new plants there has received increasing attention, albeit undermined by regional political motives. During the past decade the Soviets have taken limited steps in this direction by locating some new plants in the eastern part of the country. Most of these have been sited there to take advantage of the abundance of critical raw material or energy resources. By contrast, the Soviets have not established a large number of plants producing either finished capital or consumer goods in remote areas. These remain concentrated in western urban areas, also for economic reasons.

38. Economic development during the past decade also has been characterized by a substantial increase in the number of light industrial plants. For the most part, this effort occurred in the most sparsely

developed regions in the west which possessed relatively well-established transportation and communications networks. This dispersal, however, has not significantly lessened the overall concentration of Soviet industry in dense, urban areas. The labor surplus upon which Soviet planners based the viability of the concept is largely nonexistent and, even more importantly, diseconomies in dense, industrial areas have not become great enough to stimulate large-scale dispersal.

39. All available evidence indicates that, despite Soviet guidelines, the regional distribution of industry has remained virtually unchanged since the mid-1960s (see table V-5). Growth in remote areas has been balanced by continued expansion of urban-industrial concentrations and, in some cases, even outpaced by it. Thus, the construction of new plants and the expansion

Table V-5

#### Regional Distribution of Industrial Production in the USSR (Percent)<sup>1</sup>

Region <sup>2</sup>	1965	1970	1974
RSFSR:			
Northwest <sup>3</sup>	8	8	7
Central	17	16	16
Volga-Vyatka	3	4	4
Central Chernozem	2	2	2
Volga	7	8	8
North Caucasus	5	5	5
Ural	9	9	8
West Siberia	5	5	5
East Siberia	3	3	3
Far East	3	2	2
Ukrainian SSR	22	22	22
Lithuanian SSR	3	3	3
Latvian SSR	2	2	2
Estonian SSR	3	3	3
Georgian SSR	1	1	1
Azerbaijhan SSR	1	1	1
Armenian SSR	1	1	1
Uzbek SSR	1	1	1
Kirgiz SSR	1	1	1
Tadzhik SSR	1	1	1
Turkmen SSR	Negl	Negl	Negl
Kazakh SSR	1	1	1
Belorussian SSR	Negl	Negl	Negl
Moldavian SSR	1	1	1

<sup>1</sup> Because of rounding components may not add to 100 percent.

<sup>2</sup> The regional breakdown on which this percentage distribution is based as follows: the first 10 areas named are economic regions within the Russian Soviet Federated Socialist Republic. The remaining 14 are other republics of the USSR.

<sup>3</sup> Includes Kaliningrad, administratively under the RSFSR but included in the Baltic Economic Region with the Lithuanian, Latvian, and Estonian republics.

of existing facilities in developed areas generally have increased the number and size of plants, as well as the value of their output, by at least as much as new facilities in remote areas, despite the unusually large scale of industrial construction in remote areas.

#### Size and Location of New Facilities

40. Soviet literature indicates that civil defense considerations should be an important factor in determining the location of industrial plants. The purpose is to improve the self-sufficiency of economic regions in the production of products critical for both immediate survivability and to lay the ground work for postwar rebuilding. For example:

Measures may be taken nationally to limit the concentration of industry in certain regions. A rational and dispersed location of industries in the territories of our country is of great national economic importance, primarily from the standpoint of an accelerated economic development but also from the standpoint of organizing protection from weapons of mass destruction. A uniformly dispersed distribution of plants may be accomplished gradually by developing industry in underdeveloped regions and limiting the construction of new plants in highly industrialized regions.<sup>8</sup>

41. Our analysis of the patterns of growth of Soviet industry shows little evidence that actual Soviet practice in siting new plants, either in light or heavy industry, includes civil defense considerations. Most important is the reluctance of ministries to locate new facilities in remote areas which, although rich in natural resources, may pose considerable transport, labor, and climatic problems. To the extent that such problems can be overcome, ministries have agreed to build new plants in remote regions, but only if they can be assured that such siting will not be detrimental to plan fulfillment.

42. Since 1968 the Soviets have built some plants which appear to satisfy the requirements for national dispersal as well as the more important economic considerations. A prime example is the huge Kama River Truck Plant and its associated new town, Naberezhnye Chelny. This plant, which covers an area of 98 square kilometers, is located about 1,000 kilometers east of Moscow in a relatively isolated region. The location of the plant, near key power

sources of the Volga Region, and its size represent a victory for Soviet planners who argued for the economic benefits resulting from its configuration—greater efficiency and economies of scale—and the incidental benefit of dispersing motor vehicle production away from the traditional, large urban areas. In terms of regional dispersal, however, Kama and similar plants offer little protection from nuclear attack. In contrast to other plants in the motor vehicle industry, virtually all components are manufactured on site, rather than being shipped in from specialized plants throughout the country. Thus, even a small nuclear attack against Kama could eliminate the production of a number of parts essential for truck assembly.

43. Soviet industrial development has, especially since 1968, been characterized by gradual growth in the size of new plants. This reflects the Soviets' idea that "bigger is better," but also incorporates their belief that true economies of scale can be obtained from large plants. Horizontal integration is becoming increasingly widespread in the Soviet economy—particularly in manufacturing—and, to the extent that it eliminates a number of small, dispersed plants, is increasing the vulnerability of Soviet industry. We have little information on instances where civil defense considerations alone determined the siting of plant facilities. However, we have three reports where civil defense considerations were known to be a factor in selecting plant sites.

44. Near urban areas, new plants often have been built adjacent to major existing plants. These new facilities, which often provide specialized parts or services to the main plant, have been sited, regardless of dispersal considerations, to facilitate production. This has occurred frequently in the European USSR, particularly in the largest cities such as Leningrad. The trend toward such agglomeration may be considered a type of vertical integration and, as such, increases the vulnerability of the plant using intermediate goods from other facilities located in close proximity.

45. In numerous cases new plants have been sited on the outskirts of urban areas to lower industrial density while also taking advantage of transport and communications facilities. This phenomenon typifies the development of the area around Moscow as well as most other large, well-established industrial cities. For example, the area between the important urban industrial centers of Lyubertsy (steel structures, refined petroleum products, optical instruments, and

<sup>8</sup> Yegorov, Shlyakhov, and Alabin, *Civil Defense*, Moscow.

research institutes), Mytischi (subway, rolling stock, motor vehicles, and chemicals), and Moscow is gradually being industrialized. As a result, there is little distinction between the city limits and surrounding areas, thus increasing the size of the potential target area.

46. Regional analyses and analyses of plants in key industries indicate that, within these categories, there appears to have been a serious attempt to disperse facilities in only four categories: synthetic rubber, petroleum refining, aluminum production, and transportation equipment manufacturing. The USSR's largest synthetic rubber plant, for example, which started production in 1970, is located in a rather isolated area in the Volga - Ural mountains region, the new Mozyr Petroleum Refinery is in Belorussia away from urban centers and other plants, the Regas Aluminum Refinery was sited in isolated Central Asia, and the Kama River Truck Plant is in the Upper Volga region. We do not know what role, if any, civil defense played in determining the location of these plants.

#### Expansion of Existing Facilities

47. The Soviets also have deviated from civil defense requirements when they have expanded existing plants and complexes. Surveys of 17 key recovery industries reveal that virtually no effort has been made to increase the spacing between buildings or to locate additions in areas that would minimize fire hazards in the event of a nuclear strike. In many of the cases examined, expansion has occurred within a plant's perimeter, actually increasing building densities. In particular, previous open spaces in petroleum refineries have been filled with highly flammable storage tanks and processing units; the latter have become progressively larger over time. The reason for this trend probably centers on transportation and logistical and general efficiency criteria, the importance of which evidently outweighs the desire to conform to civil defense codes.

48. The continued expansion of existing plants has increased the value of productive capacity proportionally more than plant density in urban areas. This pattern of expansion has tended to increase the overall vulnerability of industries which often are located in an urban environment to serve consumers, provide inputs to other manufacturing processes, or to utilize inputs from other enterprises. Examples of industries most likely to be affected in this way include electronics, machine tools, bearings, synthetic rubber, and electrical equipment.

#### Territorial Production Complexes

49. An important element in Soviet economic planning is the concept of territorial production complexes (TPK in Russian). According to the Soviets, a TPK is an "interrelated combination of establishments in a particular industrial center or in an entire region . . . based on physical and economic conditions and its economic-geographic and transport situations." (See figure V-7.) As such, TPKs have been the major means to develop the unique and abundant national resources of the remote areas of the USSR, although a few are located in the more industrialized areas of the country.

50. Because most TPKs fall within the boundaries of a single economic region, they are often thought of as administrative subunits of these regions. At present, however, they are more accurately described as planning devices to overcome the traditional problems of poor industrial siting and neglect of accompanying infrastructures by industrial ministries. In either case, the size and composition of industry in given TPKs reflect economic resources of an area. Whatever the usefulness of the TPK as a civil defense measure, it is incidental to these factors and plays little, if any, role in either the composition or location of TPKs.

51. Some TPKs have increased the degree of industrial dispersal in the USSR to the extent that they are located away from highly industrialized urban areas that are likely to be targeted with nuclear weapons. Nonetheless, the establishment of TPKs represents neither a surge nor a locational shift in economic activity that would not have occurred in the absence of civil defense requirements. Discussions of future TPKs reflect the Soviet policy of continuing to plan for greater economic efficiencies and more rational development, although military organs probably also approve of these efforts. Moreover, the interdependency of individual plants within TPKs and the common use of central services make them more sensitive to disruption through loss of a key installation, such as a powerplant. Some industrial centers, despite their location away from high-density urban areas, are vulnerable targets because of their concentration.

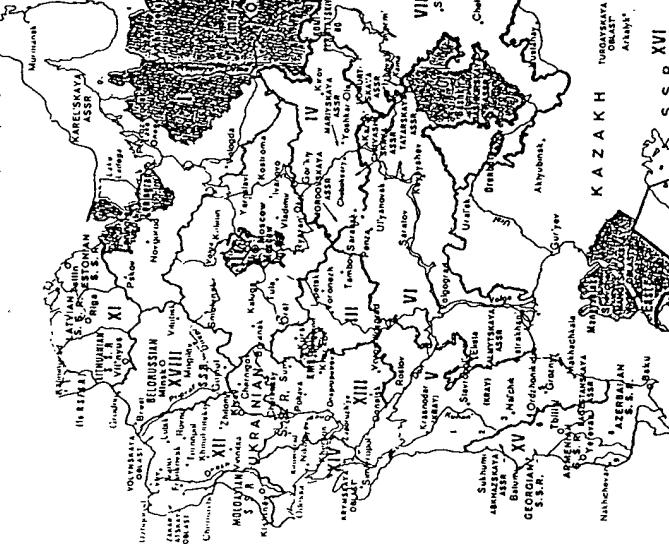
52. Finally, in a few cases, TPKs have been established by bringing the direction of existing industrial plants in a given territory under one central authority, without planning to build more plants within the complex. This is done for organizational and political reasons, such as in the case of the Leningrad Regional Production Complex, which

## Soviet Territorial Production Complexes

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**II Territorial production complex**

Soviet territorial production complexes fall within other larger complexes



Autonomous Oblasts and Republics in  
the Caucasus

- 1 Dagestan A.O.
- 2 Dagecheteo-Cherkesskaya A.O.
- 3 Karachato-Alaksayevskaya A.S.S.R.
- 4 Checheno-Ingushetian A.S.S.R.
- 5 Dago-Osetianskaya A.O.
- 6 Dagestan A.S.S.R.
- 7 Karachino-Kazakhskaya A.O.
- 8 Karachino-Kazakhskaya A.S.S.R. (in Kirghiz S.S.R.)

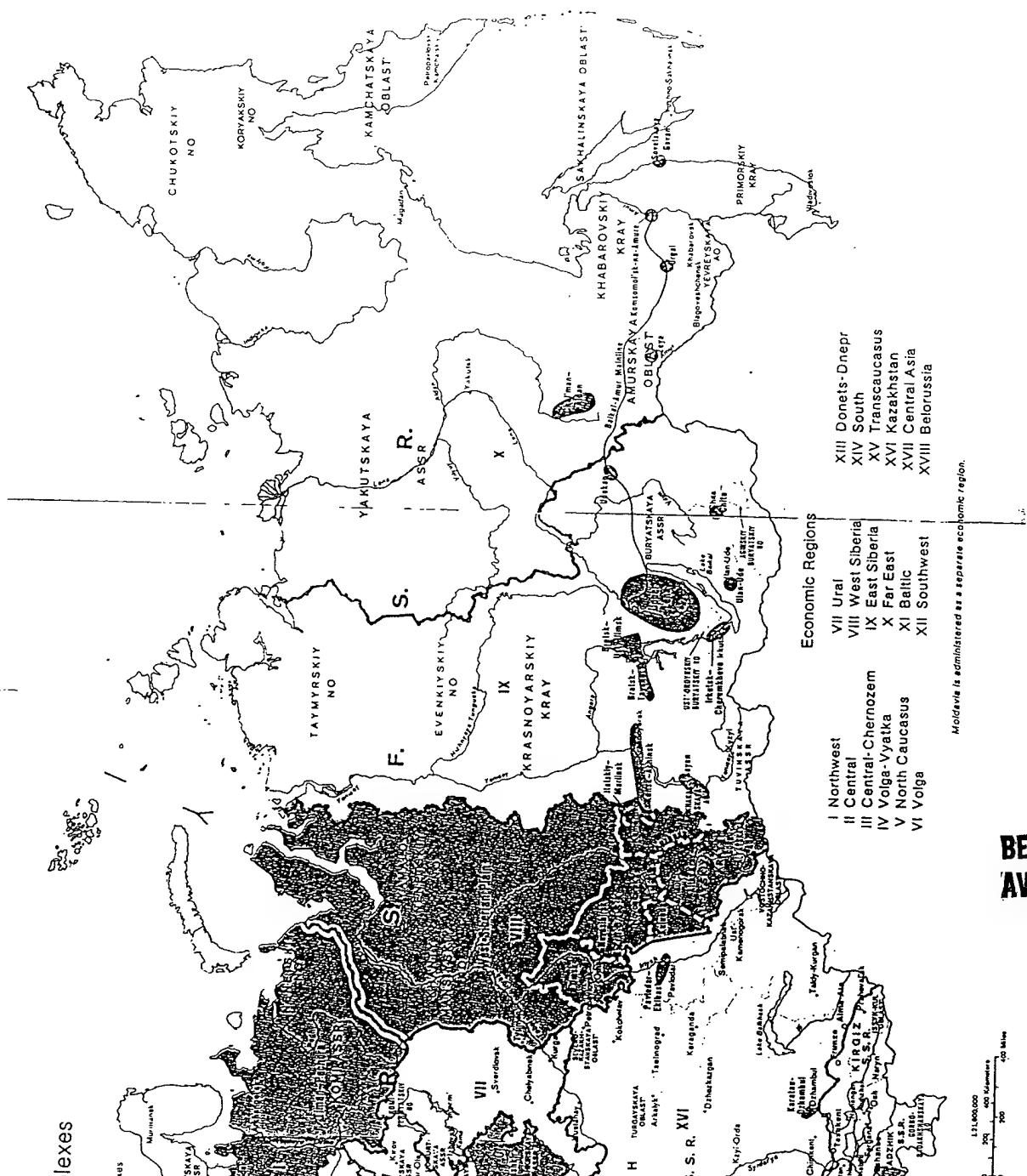
Boundary

Autonomous Oblast or Krai  
Autonomous Okrug (AO) or National Okrug (NO)

On A.P.M.A.C. as shown in some early maps  
these areas are not shown separately  
as they were not yet fully delineated at that time

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includes Leningrad City and Oblast. TPKs such as this one have had little impact on the Soviet civil defense program.

53. In sum, widely dispersed TPKs make the overall task of destroying Soviet industry more difficult, but concentrations of industries within regional complexes make them as vulnerable as if they were part of established urban areas. To the extent that TPKs increase regional self-sufficiency, they could ease the task of long-term reconstitution of the Soviet economy following a nuclear attack.

#### Urban Planning

54. In the broadest sense, Soviet urban planning for establishing new towns and expanding industrial areas of existing cities is largely dictated by the needs of associated industrial plants and complexes. The Soviets distinguish among types of new towns:<sup>9</sup>

- Industrial cities, with between 30,000 and 150,000 persons, are the most important. Each is near a specialized industry, such as petroleum refining, machine building, or metal processing.
- Central cities of administration and service for agricultural regions. The primary theoretical criterion for the siting of these cities is the availability of rail transport to ship raw materials to processing points. Some of these regional cities service areas as large as an entire republic.
- Transportation cities, which are built to capitalize on a favorable location at the confluence of rivers, railroads, and roads.
- Scientific production centers, which focus on scientific research, higher education, testing, and series production of newly developed items. Scientific centers often are formed on the outskirts of large cities.
- Cities that are centers of recreation and tourism. These are scattered throughout the USSR in areas of moderate climate.

55. Although economic, transportation, and labor considerations for the most part determine the size and location of new towns,<sup>10</sup> civil defense factors apparently are to have more influence in determining their

<sup>9</sup> In some cases, a town may fit more than one categorical description.

<sup>10</sup> To the extent that new industrial complexes are sited for civil defense reasons, the location of their associated towns may be viewed as determined by civil defense.

physical characteristics. More recent Soviet manuals, for example, still call for:

- Constructing wide roads so that rubble from buildings will not impede transportation.
- Reducing building densities and creating satellite cities.
- Creating green belts (forest areas) to separate industry from other activity.
- Creating water reservoirs.
- Building circumferential highways to help maintain the transportation network.

These criteria also are to apply to urban planning in areas of expansion of existing cities or in rebuilding old sections.

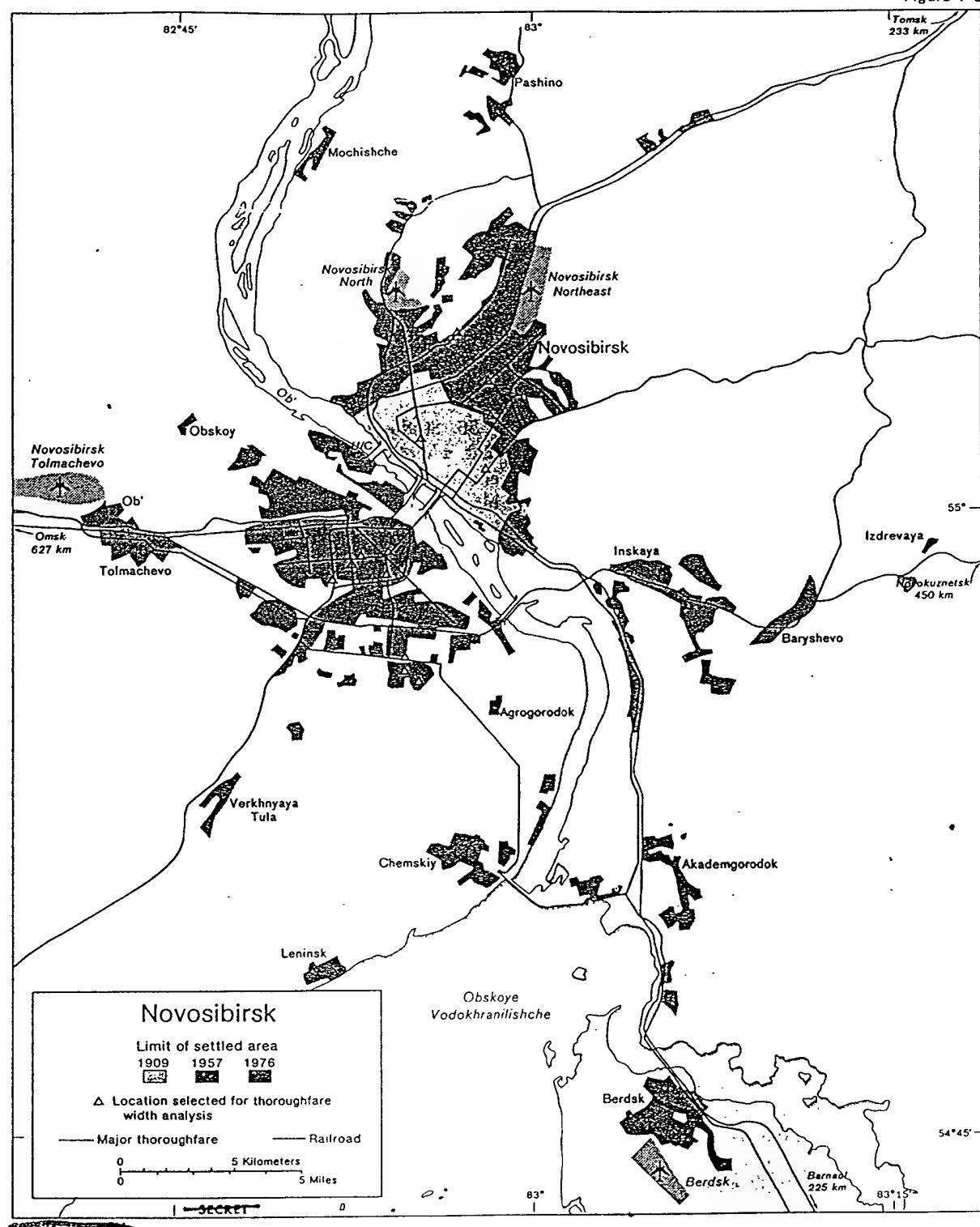
56. Studies of various regions of the USSR indicate that, where possible, the Soviets have built streets wide enough to prevent rubble from buildings from blocking them. In Novosibirsk, for example, locations were selected for thoroughfare analysis. The analysis showed that many streets are at least as wide as the average height of buildings on both sides, plus 15 meters, as stipulated in civil defense manuals. Satellite cities, such as Akademgorodok and Agrogorodok, have also been developed outside of the city. (See figure V-8.) Reservoirs and artesian wells have appeared rather frequently in photography of various oblasts, but it is difficult to ascertain their capacities, intended use, and the influence of civil defense in their construction. Other parts of the program have been carried out less frequently. Building densities in many cities, and in some cases even new towns, for example, have not been reduced substantially. In such cases, economic efficiency and spatial considerations evidently outweighed the desire to adhere to civil defense criteria.

#### Crisis Relocation

57. The 1977 Soviet civil defense textbook refers to enterprises which will "shift their operations to the exurban zone." The open literature provides no detail on this program however, since the relocation of essential industrial plants and scientific institutes during a crisis period is tied to economic mobilization for wartime production, a classified subject. Nonetheless, both historical precedent and numerous human source reports indicate that the Soviets probably would relocate key facilities if they were afforded the luxury of sufficient time. Between July and November 1941,

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Figure V-8



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for example, the Soviets moved 1,523 enterprises, nearly all of which were war plants, from the European USSR to the east, using rail cars. For many plants, only several weeks were required to resume production, although overall output dropped sharply for a year following the relocation.

58. Human source reporting indicates that current crisis relocation plans have been designed to conform more closely with the threat of a nuclear strike rather than to escape the broad acquisition of territory characterized by World War II. The mobilization plan of the L'vov Lenin Industrial Technical Union near the Polish border, which calls for the relocation of plant, equipment, and personnel to a site about 40 kilometers southwest of L'vov, was described in last year's IIM on Soviet civil defense.

59. This year, other reporting from human sources on crisis relocation suggests that this program encompasses those elements of the economy which could be moved with relative ease to new areas and continue to function. Installations named by human sources have included design institutes, research facilities, and production shops of the optics and electronics industries. Relocation of heavier industries would pose problems and we do not know to what extent such moves are planned or would be undertaken.

#### Effectiveness

60. We do not believe that the Soviets are carrying out a nationwide industrial dispersal program for civil defense purposes. Policies concerning the general pattern of economic development now and in the future will determine the extent and character of industrial dispersal. As a result, civil defense benefits can be realized only if economic development is characterized by growing dispersal of all types. Urban growth and the expansion of industry generally have made the task of destroying a given percentage of Soviet economic facilities more difficult; however, the vulnerability of many individual industrial complexes has increased because of the growing density of manufacturing processes.

61. The Soviets could effectively achieve rapid dispersal of some enterprises in a warning period through crisis relocation, but only through great effort. We believe the Soviets would undertake such an effort only under special and unlikely circumstances. Because of the scale of such a program, we believe Soviet leaders would have to be convinced that a nuclear conflict was probably unavoidable but not imminent before production were disrupted and transportation

and other resources committed to such a move. If war appeared imminent the Soviets would not have sufficient time to complete a massive industrial relocation.

#### C. Industrial Survivability

62. In their literature, the Soviets prescribe a number of engineering-technical measures to help increase the survivability of industrial facilities. In addition to increasing the physical "hardness" of structures and equipment the Soviet concept of increased survivability also encompasses such elements as rapid shutdown of industry, passive fire prevention measures, and improving the stability of production by stockpiling or protecting supplies and spare parts. Among these measures are:

- Construction of personnel shelters (see section A of this chapter).
- Hardening by use of stronger structural materials, embanking, reinforcing walls, and burying.
- Protecting valuable equipment by hasty hardening and storage in underground structures.
- Providing for a rapid shutdown of the installation.
- Maintaining a stable source of power and water by diversification, burying utility lines, and installing rapid shutdown equipment.
- Preventing fires and secondary damage by using fireproof materials in construction, removing flammable materials, creating firebreaks, and burying combustible and toxic substances.
- Stockpiling supplies and materials and preassembled articles, scattered over an area to be less vulnerable to destruction.
- Preparing to resume disrupted production by drawing contingency plans to remedy slight and medium damage.

63. Of the measures outlined above, we have concentrated in this section on those which we feel are the most important in terms of protection against US attack—mainly, permanent hardening by construction methods, hasty hardening, and rapid shutdown.

#### Construction Methods

64. The Soviets' approach to hardening is heavily influenced by economic considerations and by their

assessments of nuclear weapons effects on buildings. They readily admit that:

The raising of the resistance of the existing production buildings and structures as well as their resistance to the effect of the shock wave, in the first place, entails significant expenses, and secondly, still does not completely guarantee their survival in an area of nuclear destruction. In this regard, the carrying out of work to strengthen various structures can be planned and implemented only in the aim of protecting particularly valuable and specially made equipment, or in those instances when individual important structures possess significantly less strength than the remaining, and it is possible to bring their strength up to the average values of the plant without major outlays.<sup>11</sup>

65. According to Soviet writings hardening measures should be carried out in the process of construction or repair work, or in coordination with other measures necessary to improve conditions at installations. In general, the Soviets design and construct their industrial facilities beyond the criteria for structural strength called for by Western building practices. This has been attributed to both an inferiority in the quality of construction materials and such factors as climate and soil conditions. More massive Soviet construction, however, may increase the expected level of damage to equipment and machinery. Soviet manuals, for example, recommend that valuable machinery not be "located in the basic production building but rather in separate standing ones which have light, fire-resistant structural elements the collapse of which will not destroy this equipment."

#### Underground Structures

66. At many industrial facilities, subfloors and basements could be used to protect critical machinery, equipment, and supplies.

large underground rooms at a variety of installations which play no apparent role in the production process but also are not equipped to accommodate people. Detached and basement shelters per se could also be used to protect equipment and supplies, but we believe relatively few would be used for this purpose, given the emphasis on survivability of key workers.

<sup>11</sup> Yegorov, Shlyakhov, and Alabin, *Civil Defense*, Moscow.

Although one type of detached shelter has been identified with a long ramp (see figure V-3), this may be to facilitate stockpiling of essential provisions for human accommodation. Some of these structures probably are used on a daily basis to store supplies, equipment, and even semimanufactures. This is consistent with the Soviet "dual purpose" concept of adapting shelters to peacetime needs. In a crisis situation, these structures would have to be emptied and their readiness for shelter use checked.

67. There is little evidence to indicate that a comprehensive program for hardening economic installations is under way. In general, what evidence has come to light is as follows:

— Numerous human sources report the existence of underground facilities at economic enterprises which contain both life-support systems and the specialized equipment necessary to permit operations to continue in a nuclear environment. These underground facilities reportedly include industrial production shops, research laboratories, design bureaus, and other facilities associated with military and civilian industries. In some cases, these facilities have been reported to be completely underground while others form part of larger aboveground complexes. Although some of these reports are tenuously based on hearsay and rumors, the large number of sources reporting on underground facilities suggests that such facilities probably exist.

— Bunkerized POL and water storage facilities have been identified at many industrial facilities. While such structures may be required to protect their contents from freezing or contamination, they also serve a civil defense hardening purpose.

— Tunnels and underground conduits are extensively employed at Soviet industrial facilities to carry utilities and supplies. Again, these structures may be required for other reasons, but they do serve a civil defense purpose as well.

68. There are, however, numerous examples where construction hardening guidelines have been ignored. As noted in the previous section, increased expansion of industrial capacity at existing facilities has in many cases reduced the open space between industrial buildings. Certain industries such as steel production and petroleum refining are not easily hardened and the advanced technology of other industrial processes, particularly in the chemical industry, has in some

cases increased the vulnerability of these facilities. In many cases utility lines are aboveground both within and outside plant perimeters. While bunkered POL facilities have been observed, other unprotected POL tanks have also been built. Other methods which may be subsequently implemented, such as equipment mountings and interior walls, cannot generally be detected by photography but are largely dismissed in human reporting.

69. Available evidence on the implementation of construction hardening methods indicates that the Soviets have not engaged in a large-scale, comprehensive program to upgrade the physical hardness of industrial facilities and equipment through construction methods. The Soviets realize the difficulty and high cost of such a program and they have explicitly stated that such measures are to be carried out only when they are economically feasible. One aspect of hardening which is not addressed in this study—the inherent hardness of Soviet industrial equipment, much of which is rugged and relatively unsophisticated compared with comparable US equipment—could have a more significant impact on the overall vulnerability of Soviet industry than construction practices for industrial facilities.

#### Hasty Hardening Measures

70. Soviet civil defense manuals prescribe expedient measures to protect buildings, machinery, and equipment from the effects of a nuclear strike. These measures would be implemented during the period preceding an attack either to supplement permanent hardening or, more often, to provide the sole means of protection for an economic installation and its machinery. According to Soviet textbooks, the civil defense plan for a typical installation dictates hasty hardening (as well as other) measures that would be taken if a special period were declared. They are relatively simple actions such as:

- Reinforcing structures with metal supports and beams.
- Earth mounding of low buildings, pipelines, and other structures.
- Cable supports for towers, columns, and derricks.
- Sandbagging of equipment and various structures.
- Fireproofing with paints and special coatings.
- Sealing windows, doors, and other openings.

— Covering vital equipment with special protective structures.

— Removing valuable equipment and dispersing it within the plant or transporting it to relocation sites.

71. Soviet civil defense plans at industrial enterprises give much more detailed consideration to rapid shutdown methods which include:

- Shutting off gas and power lines.
- Banking and sealing kilns and furnaces.
- Stopping moving equipment.
- Draining tanks and reservoirs.

72. Evidence from human sources tends to substantiate the indications in unclassified writings that the Soviets have given greater emphasis to rapid shutdown than to hasty protection of buildings, machinery, and equipment. There are two possible explanations for this: first, the overall effectiveness of the hasty hardening measures is questionable, particularly in some key industries with vulnerable, high-technology plants; second, rapid shutdown is easier to achieve and requires few material inputs. The civil defense plan of some plants, however, calls for both types of measures, and in no case does the implementation of one prevent the other.

73. Table V-6 portrays those hasty hardening and rapid shutdown methods which, if implemented, would be useful for increasing the hardness of various industrial installations. These methods can be implemented in one or two weeks as opposed to construction methods which might be undertaken during plant construction or renovation.

74. Some measures such as burying machinery and rapid shutdown of industry could result in significant changes in vulnerability for selected critical facilities and equipment. Other methods such as bracing and cabling would have only a small impact on decreasing the vulnerability of various structures. Even if such methods do not significantly alter the hardness of industrial installations against primary nuclear weapons effects, such as blast, they would provide improved protection against secondary effects, such as fire and radiation. In addition, some forms of rapid shutdown could dramatically increase the longer term ability of various industries to recover and initiate production again following an attack.

Table V-6

## Matrix of Hasty Hardening and Rapid Shutdown Methods

Industrial Elements That May Be Hardened By Various Methods	Hasty Hardening												Shutdown			Other									
	Sandbag and Revet	Burial	Earth Mounding	Bracing	Cable Guy Wires	Paint	Insulate	Fireproof	Fill Cavities	Flood (Water)	Wet Down	Debris Nets and Pads	Boarding Up	Lay On Side	Turn Off Power	Cut Off Fuel	Drain Pipes	Drain Reservoirs	Dump Tanks, Pots, or Vats	Demolition	Stock Supply	Camouflage	Disperse	Stock Parts	Decoy
Buildings																									
Walls .....	X	X	X	X	X	X	X	X		X								X	X	X	X	X	X		
Ceilings and roofs .....			X	X																					
Towers and smokestacks .....																									
Windows .....					X							X													
Refineries (all types)																			X						
Storage tanks .....		X	X		X	X	X	X	X																
Pipelines .....			X	X																					
Processing towers .....							X						X	X	X							X	X		
Powerplants																									
Generators and motors .....	X																								
Boilers and reactors .....	X																								
Transformers and switch .....	X		X																						
Powerlines .....				X																		X	X	X	
Communication tower/lines .....					X								X	X										X	
Processing machines																									
Precision instruments .....	X	X							X			X													
Cutting tools .....	X	X							X			X													
Heavy equipment .....	X		X	X					X			X	X	X											
Electronics .....		X							X			X	X	X											
Office equipment .....		X							X			X	X	X								X	X	X	
Mobile equipment																									
Railroad .....	X					X																X	X	X	X
Automotive and farm .....																						X	X	X	X
Ships .....																						X	X	X	X
Aircraft .....	X					X	X															X	X	X	X
Mills and smelters																									
Blast furnaces .....	X				X					X						X	X		X	X					
Pot lines .....			X							X															
Cement kilns .....			X							X															
Acid vats and leaching .....			X							X															
Dams and canals																									
Locks .....	X	X	X													X	X		X	X					
Pumping stations .....																X	X		X	X					
Inlets/spillways .....																		X			X	X	X	X	
Fuel storage																									
Coal .....		X	X	X				X	X	X	X										X	X	X	X	
Oil .....			X																		X	X	X	X	
Natural gas .....			X					X	X	X	X										X	X	X	X	

75. Construction methods advocated by civil defense officials appear to have had little impact, if any, on reducing the overall vulnerability of Soviet industry. The limited implementation of these measures reflects Soviet concern over the cost and difficulty that such a program entails.

76. Hasty hardening measures, on the other hand, could be implemented during a crisis. Such measures would not assure the survival of any facility or equipment that is specifically targeted. On the other hand, hasty hardening measures would increase survival of those facilities that lie on the periphery of selected aim points. If such measures were known to exist at any particular facility they could be offset by an attacker through refinements in targeting and weapon selection and allocation.

77. If, however, the Soviets were able to implement their plans for hasty hardening and rapid shutdown on a comprehensive basis throughout their industries they would reduce their recovery time following a major nuclear attack. Studies of Hiroshima and Nagasaki, as well as of selected German and Soviet industries attacked during World War II, suggest that such hasty hardening measures as those described above would be useful in reducing the overall level of damage and thus shortening overall recovery time for the economy.

#### Protection of Electric Power Sources

78. In Soviet plans for the restoration of services and industrial production, the capability to produce and distribute electric power in a nuclear environment is as important as stockpiles and transportation. Recent evidence suggests Soviet civil defense authorities have made progress in this area through application of various civil defense measures. A survey of 13 selected electric powerplants in the USSR identified 13 personnel shelters at eight of the plants. A human source with extensive experience in the power industry reported that as of June 1977 the regional power station at Khar'kov had shelters for all plant personnel, plus remote control equipment permitting operation of the plant from the shelter.

79. In addition, other reliable sources have reported on the construction during the period 1970-75 of a network of power distribution centers under the Ministry of Power and Electrification which would function in wartime. The centers, which are located outside large cities, contain transformer yards, power-line connections, and shelters with space for operating personnel and for communications terminals, both

radio and telephone (via buried cables) through which power distribution grids would be operated in an emergency. The grids would cover not only the USSR but the East European nations as well. Several of these emergency power distribution centers with civil defense shelters have been identified in the Ukrainian SSR and others at points as widely separated as Karaganda in the Kazakh SSR and Vladivostok in the Far East. In the case of one center, the shelter facilities reportedly had water and food stocks sufficient to support 60 persons for several weeks. The centers have been confirmed in photography. (See discussion in chapter VI on availability of other fuels.)

#### Reserve Production Capacity

80. The average age of the capital stock in many civilian industries remains high, reflecting the Soviets' desire to use all their available productive assets in order to fulfill plan goals. There is some evidence, however, both from human sources and in the open literature, which supports the existence of at least minimal unused capacity. Reports indicate that plant officials not only frequently overstate the utilization of existing capacity in order to discourage higher production quotas, but also attempt to acquire more new machinery and equipment than is necessary to meet planned goals. Thus, there is some excess capacity which could be used in a national emergency. There is little evidence, however, to indicate either its extent or distribution among industries.

81. In contrast to the production of nonmilitary items, the Soviets have deliberately constructed excess capacity in their defense industries. The Soviets' capacity to produce military goods can be increased by converting from production of nonmilitary items. At the Vilnyus Microelectronics Plant, for instance, production for nonmilitary use was to stop as soon as a "special period" was declared, and only essential military items made. As reported in other cases, quality control standards are to be reduced concomitantly.

82. The Soviets do not appear to have embarked on a program to establish redundant facilities to produce items essential for either immediate survivability or for the longer term recovery of Soviet society, except to the extent that such redundancy is provided by low economic concentration. For some military items, however, the Soviets have also built redundant plants. Tanks and armored personnel carriers, for example, are produced in several plants, each of which probably

could increase its output significantly above current levels.

#### Strategic Reserves

83. The Soviets' capacity to continue production in the postattack period also depends on their on-hand inventories and reserves of raw and processed materials. Some rough estimates of the amount of time production could continue by drawing down inventories are possible. As indicated in a 1966 input-output model of the Soviet economy using Soviet data, none of the industries in the model could continue at prewar production levels more than several weeks without access to additional raw materials and manufacturing components. It is difficult to extrapolate these results, which are based on 1966 data, to the present time. We continue to receive reports concerning the existence of stockpiles and strategic reserves of industrial materials, but we still have little new evidence on their location and magnitude. Such evidence as we have suggests that some inventories are erratic, especially in those sectors heavily dependent on agriculture. On the other hand, the Soviets place great emphasis on preparations for the wartime continuity of industrial production, and the development of stockpiles and strategic reserves of materials may be more extensive than the evidence suggests.

84. In recent years the Soviets have publicly espoused the balanced development of economic

regions to reduce their interdependencies for supplies and raw materials. At the same time, they have continued to develop their transportation network in an effort to facilitate the distribution of material. Still, economic, political, and geographic factors continue to militate against autonomous economic regions, while the size and extensive development of the USSR present Soviet planners with major transportation problems. To help offset deficiencies in distribution of industrial and consumer goods, the Soviets have stockpiled bridging equipment, steam locomotives, and railroad rails and ties in excess of that required for regular maintenance. They have also built shelters for the protection of essential railroad operations personnel.

85. The inability to identify and locate major stockpiles and strategic reserves of supplies and equipment precludes a directed attack against these resources. Attacks against industry in general would reduce the overall level of supplies on hand, but it is likely that supplies would be available at surviving industrial facilities to allow production to continue for several weeks following an attack. The adequacy of strategic reserves for continuing production over a longer period, however, would depend heavily on the survivability and availability of the transportation and electric power systems. The impact of deficiencies in these areas can probably be reduced if the personnel and equipment essential to the operation of these systems can be protected.

## Chapter VI

### PROTECTION OF THE URBAN POPULATION

1. The most recent edition of the Soviet manual *Civil Defense*, published in 1977, describes preparations for the protection of the population as follows:

The preparation for protective measures should be carried out in peacetime on the entire territory of the nation and in an obligatory procedure. The scope and character of these measures are determined in each specific instance, considering the particular features of the individual areas of the country and the national economic installations, as well as the probability of an attack on them with nuclear, chemical, or bacteriological weapons.

Under today's conditions, the protection of the population is carried out by implementing a range of measures including three methods of protection: (1) protecting the people in protective structures, (2) dispersal and evacuation, and (3) supplying individual protective gear.

The basic method of protection is the sheltering of people in protective structures, but the dependable and most complete protection is achieved by combining all these methods considering the specific situation.

Such Soviet statements about protection of the population most often refer to all elements—the leadership and the essential workers, as well as those elements not essential to immediate post-nuclear-attack operations. In previous sections of the IIM we discussed protection of the leadership and essential personnel; in this section we assess protective measures for the entire Soviet urban population, including both essential and nonessential personnel except where specifically noted otherwise.

#### A. Shelters

2. Since 1968, the Soviets have built a large number of shelters, but most are at industrial, administrative, and institutional facilities. Although shelter spaces for the urban population have also increased since 1968, we believe they could not presently shelter the major

portion of their urban population within urban areas. Evacuation away from likely targets, therefore, remains a key element of Soviet civil defense.

3. Since last year we have acquired much more evidence on the number, size, and organizational association of shelters as a result of an extensive research effort by the Intelligence Community. Analyses have been made of the probable hardness of the several types of shelters, allowing assessments of their vulnerabilities. Although both the open literature and human source reporting describe evacuation procedures, we still have only limited information about certain aspects of Soviet capabilities to assemble, transport, protect, and support urban populations at evacuation sites. We have evaluated the effect of evacuation and sheltering on population survival; our findings are most sensitive to assumptions about the warning time available prior to an attack for the Soviets to complete final civil defense preparations. The evaluations in this section of the Soviet ability to distribute essential supplies and medical services for their general population during a postattack period are largely subjective judgments, but they too are sensitive both to warning time and to the nature of the US attack.

4. As stated in the chapter covering protection of the economy, the Soviets have designed and constructed many built-in and detached shelters for the protection of the urban population. Subways also have been designed for civil defense applications, but are not included in our analysis of shelter capacities.<sup>1</sup> Other structures (lower floors of multistoried buildings, basements not specially configured as shelters, and the like) which would afford some blast and radiation protection, also have not been included.

5. In addressing the availability of shelter space for the population as a whole, no attempt is made to

<sup>1</sup> Only six Soviet cities have operating subway systems. Adding the shelter space of stations and platforms would not change our estimate of total shelter space. Adding the shelter space in track tunnels would alter our estimate only slightly (less than 1 percent). Use of tunnels would preclude use of the systems for transportation purposes.

separate those shelters which may be allocated for essential personnel alone. Rather, we have evaluated the overall Soviet civil defense shelter program in urban areas. In some cases we have been unable to associate shelters with specific installations, and we do not know how available shelter space would be allocated in all circumstances.

6. In analyzing the overall Soviet shelter program, we deal with the numbers of shelters identified, classify them according to type, consider the pace and priorities of the program, determine shelter capacities

and finally present our estimate of the total urban population which could be sheltered. The data in these analyses are derived from several collection programs, and while other intelligence sources were used, the bulk of the evidence comes from overhead photography, the limitations of which were described in the Introduction.

7. The principal contribution to this analysis of the shelter program involved coverage of several geographic areas and individual cities as described in chapter I. (See table VI-1 and figure VI-1.) In addition

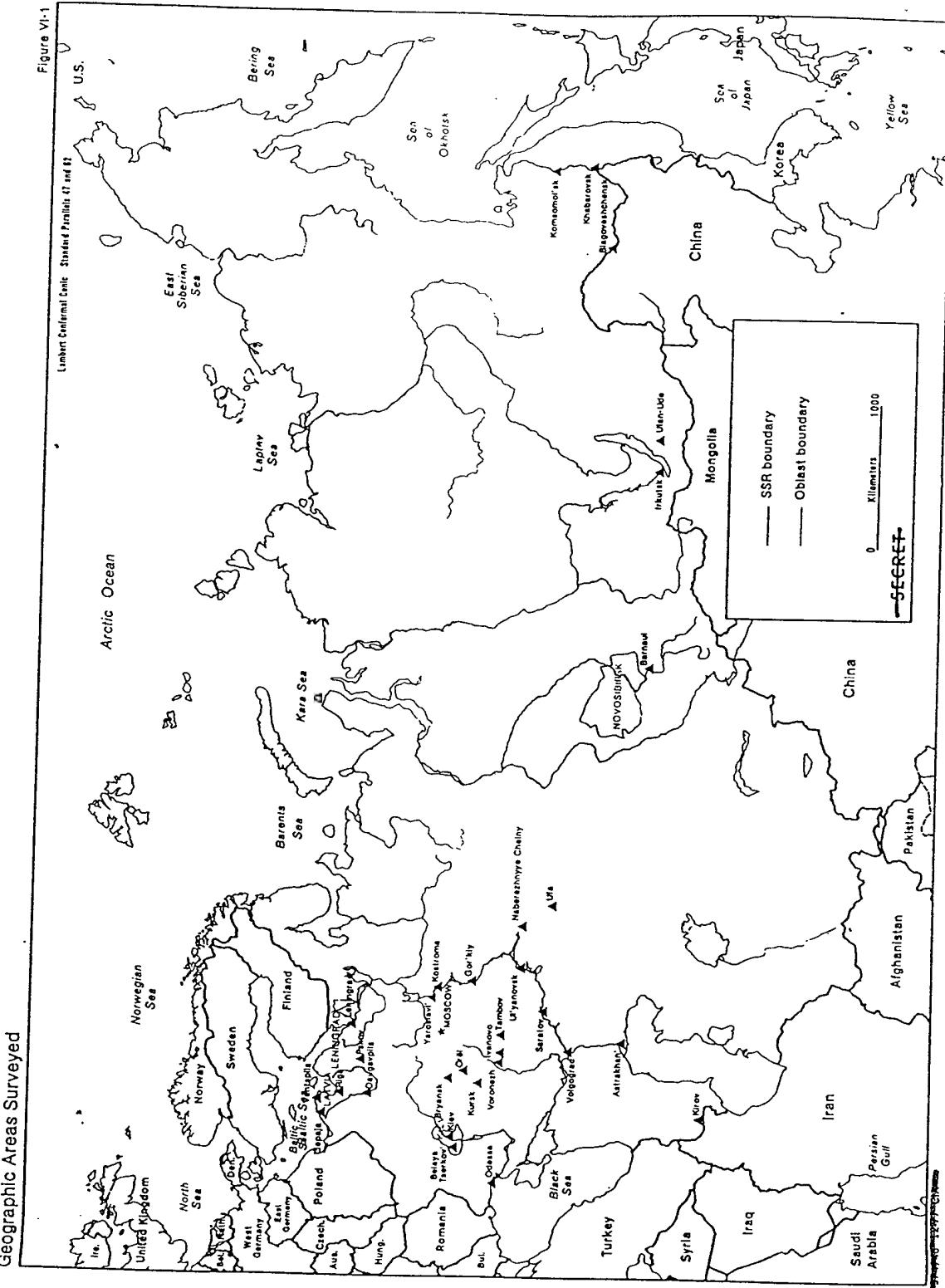
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Geographic Areas Surveyed

**Figure VI-1**

Lambert Conformal Conic Standard Parallels 47 and 67



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to studies of entire geographic areas and cities, several categories of civilian and defense industries were also studied as described in chapter V. To the number of shelters identified in these regional and industrial surveys we have added those shelters identified by other intelligence sources.

Numbers Identified

8. [ ]

analysis of all-source evidence on shelter construction, we conclude that there are more basement shelters in most of the areas than shown in our figures.

13. The insights we have obtained on Soviet priorities for shelter construction offer interesting parallels to the conclusions reached earlier in this paper on the priorities of the civil defense program. Soviet emphasis on the protection of key officials is supported by our findings. [ ]

[ ] from  
the numbers of shelters identified to date, there is evidently a nationwide shelter program.

Types of Shelters

9. In our analysis of the shelter program we have divided shelters into pre- and post-1968 periods and into the two standard construction types, detached and built-in, as described in the previous chapter. In 1968 an important Soviet decree was issued, requiring that civil defense shelters be included in all new construction.

10. Many of the buildings constructed in the 1950s and 1960s have basement shelters. Detached shelters built prior to 1968, which appear more primitive and may date from World War II, have also been identified in many areas. The Moscow subway, which was used as a bomb shelter during World War II, has been subsequently expanded. Since World War II subways were constructed in Leningrad, Kiev, Baku, and Tbilisi which have some civil defense shelter applications.

Pace and Priorities

11. The pace of shelter construction since 1968 has not been uniform in the several regions and industries surveyed. Rates of construction varied widely among cities from year to year since 1968. We do not know the reason for this apparent unevenness in the pace of shelter construction. It may be due to the categorization of Soviet cities for civil defense purposes, the availability of resources in an area, or to our lack of complete information.

12. In terms of total numbers, more built-in (basement) than detached shelters were found, although detached shelters are more easily detected. Based on

[ ]  
Shelter Capacity

14. Our method for estimating the total urban shelter capacity in the USSR as a whole, using the sample data, was the same as that described in chapter V for estimating shelter capacity at economic facilities. We estimate that two-thirds of the available space in a shelter is for personnel and that the occupancy factor range is 0.5 to 1 square meter per person. Of 32 cities surveyed, 15 were selected as a basis for our estimate of the total shelter capacity for all cities with over 100,000 population (see table VI-2). Our selection was made on the basis of population and availability of information. For three of the 15 cities selected, shelter area was obtained by scaling up the available area figures given for the fraction of the city actually searched.

15. To estimate the percentage of the urban population protected for cities of over 100,000 population in the Soviet Union, it would be necessary

Table VI-2

## Shelter Survey Results at 15 Soviet Cities

City	Available Shelter Area <sup>1</sup> (thousand sq m)	1976 Population (thousand)	Percentage of Population Sheltered <sup>2</sup>
Leningrad .....	219.2	4,372	10/5
Kiev .....	540.4	2,013	54/27
Odessa .....	70.0 <sup>3</sup>	1,023	14/7
Gor'kiy .....	113.0	1,305	18/9
Ufa .....	26.8	923	6/3
Riga .....	174.0	806	44/22
Khabarovsk .....	41.6 <sup>4</sup>	513	16/8
Irkutsk .....	21.5	519	8/4
Ulyanovsk .....	30.3	436	14/7
Ulan-Ude .....	30.8 <sup>4</sup>	302	20/10
Komsomol'sk .....	27.3	246	22/11
Naberezhnye Chelny .....	70.1 <sup>4</sup>	225	62/31
Belya Tserkov .....	6.5	137	10/5
Daugavpils .....	5.5	112	10/5
Liepaja .....	21.4	103	42/21
Total .....	1,398.4	13,035	22/11

<sup>1</sup> We have allocated two-thirds of the total floorspace of shelters for personnel, since we know that roughly a third of the floorspace is taken by life support equipment and supplies.

<sup>2</sup> At 0.5 square meter per person/at 1 square meter per person.

<sup>3</sup> Estimated.

<sup>4</sup> Scaled up estimate for entire city.

to assume that these 15 cities are representative of all such cities in the country. This is not the case, since these cities were not randomly selected. Furthermore, such factors as population size, economic distribution of industry (for example, heavy industry versus agriculture), and geographic location may all be important in determining the extent of Soviet civil defense activity at a specific city. If, however, the 15 cities were representative, then one method for estimating the overall fraction of population protected would be to use the ratio between the total available shelter area at the 15 cities and their total population. This estimate is  $1,398,400 \div 13,035,000 = 0.11$  (at 1 square meter per person). This approach yields an estimate that a minimum of 11 percent of the Soviet urban population can now be protected (or 22 percent at 0.5 square meter per person). The 95-percent confidence bounds on this estimate, based on sampling error alone, indicate that the actual percentage lies between 4 percent and 17 percent (at 1 square meter per person). These confidence bounds do not take into consideration factors such as the estimation errors in scaling up available shelter area, errors in measurement of detected shelters, undetected shelters at each of the cities, and any bias due to the unrepresentativeness of the 15 cities. Thus, the real confidence bounds

of the estimate may be considerably larger than those given because of sampling error alone.

16. An alternative statistical approach to estimating the fraction of population protected is the least squares method. Area and population may be each plotted on a logarithmic scale. The points on this log scale should lie approximately on a straight line, indicating that the percentage of population sheltered is about the same in small and large cities in our sample. However, there are wide variations from city to city. Using this method, it is possible to obtain the best fitting line through the 15 points. The least squares line corresponds to a constant proportion of 0.13. Thus, using this approach, the estimate of the percentage of population protected is 13 percent (at 1 square meter per person). This corresponds very well with the ratio estimate of 11 percent discussed earlier.

17. Thus, we estimate that a minimum of 10 percent of the Soviet population in cities with more than 100,000 people could be protected at an occupancy factor of 1 square meter per person and 20 percent at 0.5 square meter per person. For a more detailed discussion of the statistical methodology involved in this estimative process, see annex C.

### Subways

18. The role of the subway systems in Soviet plans to cope with nuclear effects was alluded to briefly in the 1976 IIM on Soviet civil defense. New information received since then, together with additional analysis, has provided a better understanding of the methods whereby subway systems appear to enhance the Soviets' ability to implement overall civil defense plans for protection of the population in key urban areas. Six systems are now operating and 11 more are in various stages of planning and construction (see figure VI-2).

19. Although subways constitute an essential element of urban transportation resources of major cities in the USSR and Eastern Europe, their civil defense applications have been given high priority. Were this not the case, urban transportation goals could have been met without incurring the additional expenses creating those features of subway systems which seem linked to civil defense requirements. According to extensive human source reporting, facilities meeting these requirements have certainly received such priority in the construction of the Moscow, Leningrad, and Kiev subways. Although there is less information from human sources on the Khar'kov, Baku, and Tbilisi systems, it is likely that all systems presently operating, and those planned for the future, will incorporate some or all of the same technical concepts.

20. Chapter IV has referred to the interrelationship between the subway systems and facilities for protection of the leadership. Moscow pioneered in the construction of multistoried underground shelters and their linkup with deep subway stations. Many of these structures are accessed directly by special stairway or elevator from offices above them, while the subway system provides alternate access. Expansion of this network has continued and has been noted in photography as well as extensive human source reporting. The most recent example is the tunnel running from the new RSFSR Council of Ministers building in Moscow to the Krasnopresnenskiy subway station. In Kiev and Leningrad, where certain of these underground protective structures existed before completion of the subway system, the linkup was accomplished as new subway construction progressed.

21. Facilities for protecting other elements of the population in subway systems are less well understood and it is sometimes difficult to separate such structures from those intended for the leadership. Best known, and the subject of considerable human source reporting and hand-held photography, are the heavy doors

with hermetic closures for sealing off subway station platforms from surface entrances. A human source with extensive experience in the Leningrad subway system reported that similar closures were erected in 1969 in tunnels at either end of the stations to seal station platforms from the track tunnels. All closures could be sealed automatically by central control or independently at individual stations. As of 1975 the Leningrad subway management was experimenting with biological filters, which would improve air quality and also cope with toxic substances which might enter the ventilation systems. The foregoing suggests that consideration has been given to use of the station platform areas as shelters, perhaps in connection with the shelter structures described below.

22. Several sources have reported on the existence of underground structures adjacent to, and on approximately the same level as, the subway stations which could provide shelter for large numbers of people. These shelters were built at the same time as the deep subway stations. Access to these structures is from the station platforms or tunnels near stations. A reliable source has confirmed the existence of such access in the Leningrad subway. These structures reportedly have extensive sanitary facilities (unlike the subway stations and tunnels), food, water, and medical supplies. That they are intended as civil defense shelters is indicated by a report from a former member of the civil defense regiment at Kolpino near Leningrad, whose company participated in an experiment in a Leningrad subway shelter structure to test psychological reactions to a five-day stay under shelter conditions. The shelter, measuring 40 by 20 meters, was one of the several in a complex which was located just beyond the station platform. The same source reported that these shelters had filtered ventilation systems which were inspected, maintained, and operated by career NCOs of the Kolpino civil defense regiment.

23. In addition to the use of station platforms and adjacent structures as shelters, there has been speculation that subway tunnels would be used as shelter space. While no knowledgeable source has supported this speculation, its origins may be traced back to World War II practices in Moscow and to civil defense posters printed in 1969 which show individuals seeking shelter entering tunnels on boards placed temporarily over the tracks. (See figure VI-3.) It is conceivable of course that the boarded section served only to provide access to the shelter structures described above. In certain circumstances it might be possible to use tunnel space, but ventilation, sanitary

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Subway Systems in the USSR

Figure VI-2



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facilities, supply, and crowd control would pose problems.

24. There is no consensus among human sources concerning the procedures and priorities governing use of subway platforms and adjacent shelters to supplement other urban shelters. However, several sources who participated in civil defense leadership training courses were told by their instructors that the subway system would provide fully equipped and stocked shelter facilities for thousands of people. Others, whose places of employment were scheduled to relocate in a "special period" and who had no or insufficient shelters of their own, were required under their civil defense plan to proceed to a specific subway station in the vicinity of their enterprise. This would occur if they had no time to carry out their planned relocation. These reports indicate that subway shelter space will be allocated in advance. This view is supported by some sources who claim that use of subway shelters will be restricted to specific groups and that the heavy closures are essential to control access to the system, not only in its shelter mode but as a protected transportation system as well.

25. There is little information on the projected use of subways to effect the concealed evacuation of key personnel, either in the "special period" or in a poststrike situation. It has been reported in general terms by several sources, and recent efforts of various subway systems to combine or link up with suburban rail lines support the logic of this concept. (See figure VI-4.) It is evident, however, that if the systems are to serve evacuation requirements and shelter needs, use of track tunnels on a large scale for shelter is ruled out.

26. It is not possible to provide an accurate estimate of the number of people who could be sheltered in the six subway systems now operational. There are too many variations in the systems (for example, the number of deep, as opposed to shallow, stations). More important, we do not know the number of subway-associated shelter structures, nor how the spaces are to be allocated. Nevertheless, the subways do constitute a significant civil defense shelter resource. (See table VI-3.)

#### Habitability of Shelters

27. As indicated in the section on shelters for essential personnel, we have limited information regarding the adequacy of food and supplies and the presence and condition of life support equipment in these shelters. Soviet plans call for the population to

bring a three-day supply of food with them; therefore, it is likely that few shelters are prestocked with food.

28. With an occupancy of 0.5 to 1 square meter per person, the factors that directly affect shelter habitability are as follows:

Factors	Soviet Specifications*	
	Normal	Allowable
Volume of air per person per hour	7.20 cu m	2 cu m
Oxygen content	21%	15%
Carbon dioxide content	1% maximum	3% maximum
Temperature maximums	23 C	30-32 C
Humidity maximums	70%	90%
Toilet	1 for 25 persons	variable

\* These data derive from Soviet documents and human source reporting.

29. Most of the shelters now being built appear to be of the type employing air regeneration facilities, plus small amounts of outside air and backed up by a supply of compressed air in tanks. This option allows for periods of complete hermetic sealing and for periods of temperature increase when supplemental air may be needed. Shelters which obtain all air from the outside have been reported. The allowable period of hermetic sealing without backup air supply is a factor particularly sensitive to overcrowding.

30. The per person allowance of 2 cubic meters per hour of air is judged an adequate minimum. A shelter occupant could survive with about one-fourth that amount under resting conditions. The air regeneration system mentioned (superoxide), supplemented with particle- and toxic-chemical-filtered outside air, plus an internal emergency air supply, should afford adequate protection under most nuclear attack conditions. Shelters in target areas using filtered outside air as the sole air source may have to be hermetically sealed in the event of a mass fire. Such shelters usually can be sealed for several hours before carbon dioxide levels rise substantially over 3 percent.

31. Soviet ventilation specifications listed above as allowable were stated to be adequate for sustained periods (presumably several days) without harming health or working ability. However, temperature, humidity, and gas percentages would allow only for short periods of minimum exertion. Under these conditions, any overcrowding would be dangerous. Soviet documents are to specify one toilet per 25 occupants. This would represent a minimum number

Table VI-3

Shelter Capacity of Subway Stations<sup>1</sup>

City	Number of Underground Stations	Platform Area (sq m less 300)	Total Usable Platform Area	Shelter Capacity <sup>2</sup>	Percent of Urban Population <sup>2</sup>
Moscow .....	92	2,652 (164 m x 18 m)	243,984	243,984/487,968	3.2/6.4
Leningrad .....	34	1,812 (157.6 m x 13.4 m)	61,608	61,608/123,216	1.4/2.8
Kiev .....	11	1,125 (95 m x 15 m)	12,375	12,375/24,750	0.6/1.2
Baku .....	12	1,125 (95 m x 15 m)	13,500	13,500/27,000	1.0/2.0
Khar'kov .....	8	2,250 (170 m x 15 m)	18,000	18,000/36,000	1.3/2.6
Tbilisi .....	9	1,125 (95 m x 15 m)	10,125	10,125/20,250	1.0/2.0
Total .....	166		359,592	359,592/719,184	2.0/4.0

<sup>1</sup> Since platform dimensions of some newer stations are not known, estimates of total usable platform area are based on the largest category of stations for which dimensions are available.

<sup>2</sup> At 1 square meter per person/at 0.5 square meter per person.

and would present an increased danger of individual toilet failure.

32. Soviet literature indicates concern about those habitability factors which could contribute to limitation of shelter stay time, such as failure of air regeneration systems, outside air filter failure, sewage backups or leaks, overcrowding, spoilage of stored food, or in the case of shelters using only outside air, being forced to remain sealed for periods in excess of those recommended. Thus, we believe two weeks at capacity occupancy under the most favorable conditions probably would represent the maximum period of reasonably safe use. However, since human sources indicate that some shelters are poorly maintained and the essential equipment such as doors and ventilators are sometimes inoperable, the habitability of these shelters may depend to a large extent on the length of time available to prepare shelters for occupancy.

33. The use of subways as shelters would be limited by many of the same factors described above. Soviet subways have ventilation systems for normal operation, but it is not known if they are all now provided with equipment for filtering air taken in from outside or if the air intakes can be sealed to prevent the entry of contaminated air. At the entrances of many stations heavy doors have been installed, presumably for blast protection but also capable of providing a thermal barrier and protection from fallout contamination.

Subway stations themselves have no food and water supplies or sanitary facilities capable of supporting a large number of people for an extended period of time. Human sources have reported that the shelter structures constructed adjacent to the stations have supplies and facilities. However, we have not confirmed this.

## Hardness

34. As indicated in the section on shelters at industrial enterprises, Soviet standard construction specifications for built-in and detached shelters range from 100 to 200 kilopascals (14 to 28 pounds per square inch). These design specifications ("sure safe" survival) are not weapons related. Our technical analysis of these structures indicates a range of 350 to 1,030 kilopascals (50 to 150 pounds per square inch) for achieving a 50-percent probability of severe structural damage. (See table V-4 in chapter V for shelter hardness against various US weapons yields.) Depending on the thickness of the concrete roof and earth overburden, these shelters could provide protection against radiation from a protection factor (PF) of 100 to a PF of 1,000 or more.

35. Subways would provide protection against both blast and radiation. Many stations are 30 to 60 meters underground but even the newer, shallower stations would provide protection from both blast and

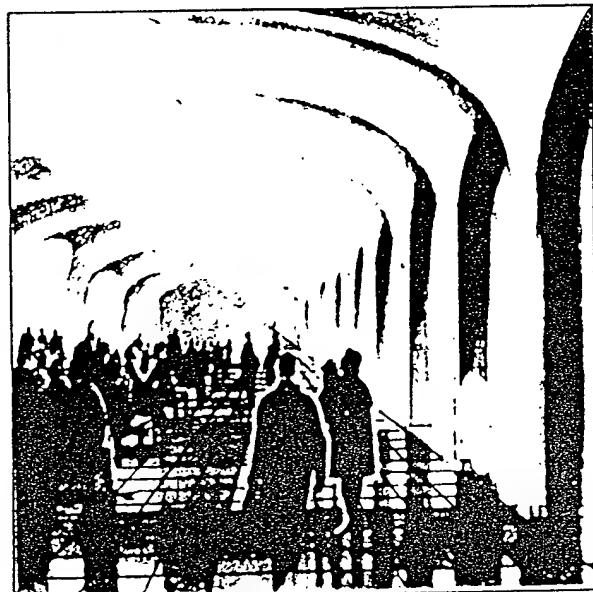
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Soviet Civil Defense Poster Showing Subways as Protection for People

Figure VI-3

"Subways have a capability for providing a high level of protection and are a very modern means of collective protection for people against weapons of mass destruction."

"The underground platforms and transit tunnels of subways are used for quartering people."

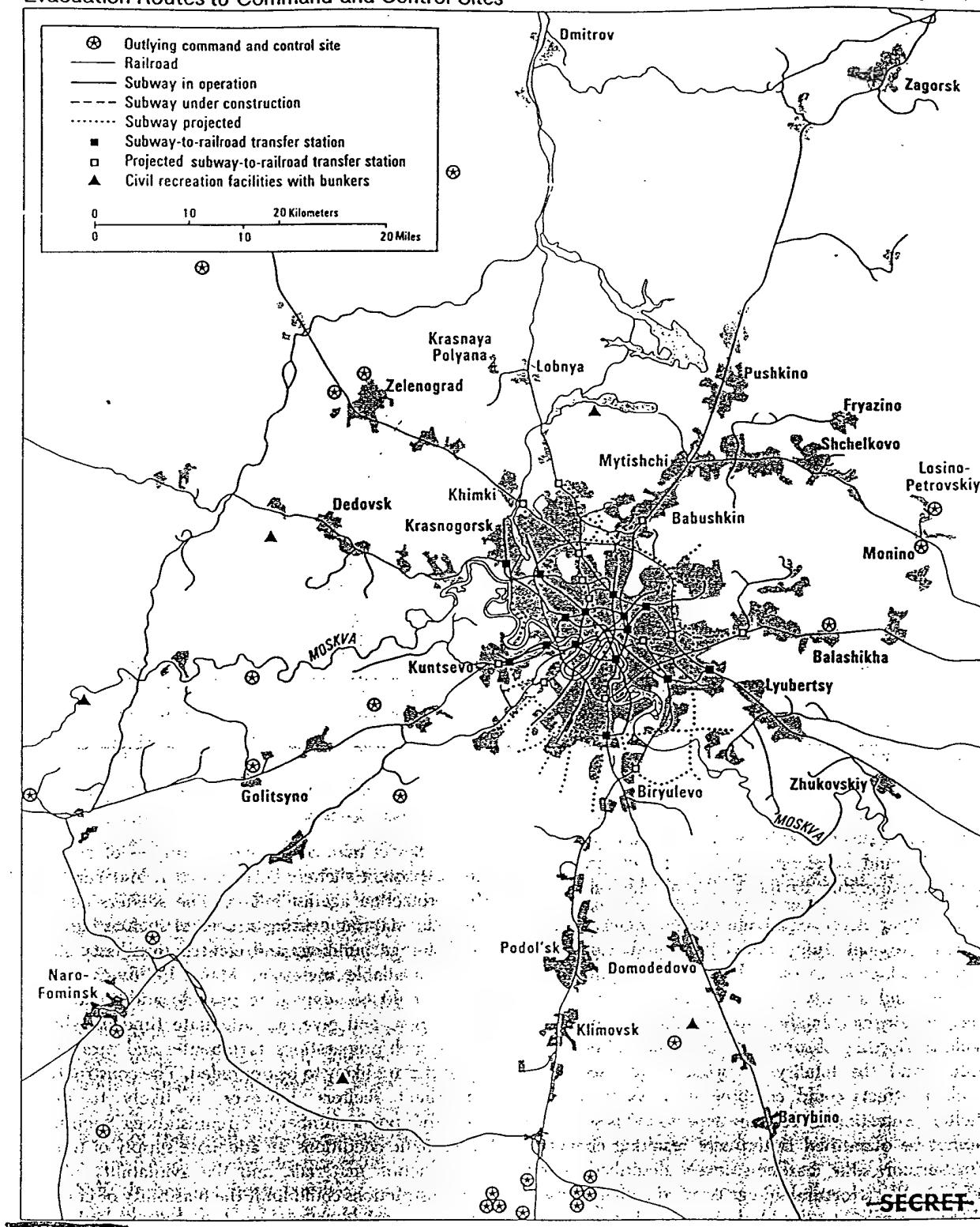


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MOSCOW: Interconnected Subway-Railroad Potential Evacuation Routes to Command and Control Sites

Figure VI-4



radiation. (Figure VI-5 displays the probability of producing casualties as a result of ground acceleration.) Ground acceleration is the factor producing most damage due to the depth of the subways.

36. Other effects of a large nuclear attack, some of which are not fully understood and cannot be anticipated, could increase the overall vulnerability of shelters and subways. For example, extensive fires may impair the habitability of detached and basement shelters; flooding of subway tunnels and stations could occur; and the totality of primary and secondary nuclear effects could combine in ways to degrade shelter protection more than expected. These effects cannot be quantified in terms of resulting casualties. Furthermore, the hardness levels described herein refer to the structural integrity of the shelter itself. Shelter occupants could become casualties even though the shelter remained intact.

#### Expedient Shelters

37. Soviet manuals provide examples of constructing expedient shelters both in urban and rural areas for protection against fallout. The shelters described include adapting existing structures such as basements and storage buildings and constructing hasty shelters using available materials. Many buildings in rural areas could be adapted to provide additional fallout protection, and given an adequate time in which to make such preparations, farmhouses and rural storage facilities are likely to be upgraded. The construction of expedient shelters, however, is likely to depend heavily upon a number of circumstances. Such factors as climatic conditions, an adequate supply of tools and construction materials, and the availability of plans and instructions could limit the feasibility of constructing freestanding aboveground or underground expedient shelters.

38. The Soviets also have a program for the emergency construction of blast shelters using available, prefabricated, reinforced concrete structural components of the type commonly used by municipal utilities. This approach was first described in a 1972 civil defense manual on methods for constructing expedient blast and radiation shelters. (See figure VI-6.) A source who worked at a plant in Leningrad producing prefabricated reinforced concrete products reports that, as of the fall of 1973, officials from the city civil defense staff visited the plant to inspect components produced there for the public utilities. The civil defense officials described their interest in using these components to build blast shelters which could be erected in a short period of time. A second source from Odessa reported that as of 1976 his construction firm was tasked to build rapidly erected blast shelters during the "special period," using prefabricated components normally available to the firm. Upon declaration of a "special period," elements of the firm would proceed to industrial sites previously designated by the Odessa civil defense staff and erect blast shelters with capacities of 40 to 120 persons. This action required a maximum of 72 hours to complete. Other human sources, with extensive experience in construction projects using the components in question, have confirmed that these structures could be erected in the time frame indicated (48 to 72 hours).

39. Soviet intent to supplement permanent blast shelters in urban areas was highlighted in the 1977 textbook which stated: "With the onset of a threat of attack, rapidly erected blast shelters are constructed to provide complete protection to the population of cities. These structures, in terms of their protective properties, are almost as effective as shelters built ahead of time." The capacities of various types of rapidly erected shelters range from 65 to 200 persons, at an occupancy factor of approximately 0.3 square meter. Hardness factors, depending on components used, are reported to range from 28 to 110 kPa (4 to 16 psi) for one type and 200 to 310 kPa (29 to 45 psi) for the largest units. We have not, however, conducted vulnerability analysis on these structures. Imagery confirms that these components are in general use in many areas of the USSR and, in one case, shows three of these structures at a civil defense training facility in the USSR. It has not been possible to quantify the additional blast shelters which would be available in urban areas through this program.

#### Program Effectiveness

40. The Soviet urban shelter program would provide adequate protection for 10 to 20 percent of the urban population at a minimum, depending on the occupancy factor assumed. In the event of a US attack intended to maximize damage to military and industrial targets; but without urban evacuation, the shelter program alone would have only a marginal impact on reducing the total number of urban casualties. (See the section on evacuation, below, and chapter VII for a discussion of the effects of shelters and evacuation in reducing casualties.)

41. A detailed analysis was made of the survivability of shelters at industrial facilities in the Kiev urban area. As weapons were employed in a simulated attack on targets in the area to maximize damage to economic facilities and military installations against this type of attack, the analysis showed that:

- A large percent of the hardened shelters at industrial facilities provided a high level of protection for the occupants against the prompt nuclear effects.
- More than 80 percent of the shelters at industrial facilities would have survived even if all shelters were rated at their design level of hardness discussed in Soviet writings.
- At our estimated hardness for these shelters—350 kPa (50 psi) or more—more than 90 percent of these shelters could be expected to survive with little or no damage.

#### B. Evacuation

##### Concept

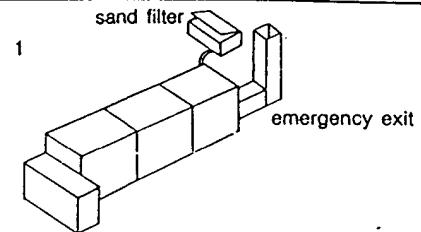
42. Soviet civil defense manuals and other publications state that those people not required to support economic activity in potential target areas will be evacuated to areas outside possible zones of destruction. These areas can be as far as 200 kilometers away from cities, sometimes crossing oblast boundaries, but generally within the same military district. There are no time requirements set by the Soviets for the length of stay in these areas.

43. Evacuation of the population is organized and planned through the place of work, study, or residence. Civil defense staffs at these facilities are required to draw up lists of personnel and families to be evacuated and their planned reception areas. This information is then provided to the rayon evacuation

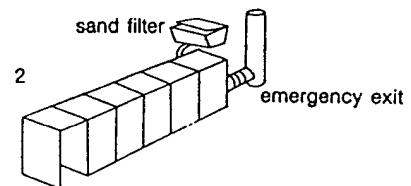
Sketch of Shelters Constructed from Conduit Sections

Figure VI-6

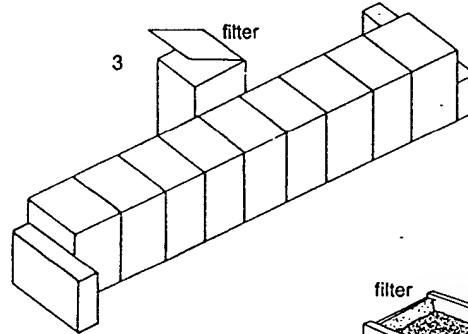
1. Shelter for 70 persons from three dimensional sections (OMK-2.4 x 2.4) of main conduits, welded version (analogously from elements of RK-25, TB-3 and other types).



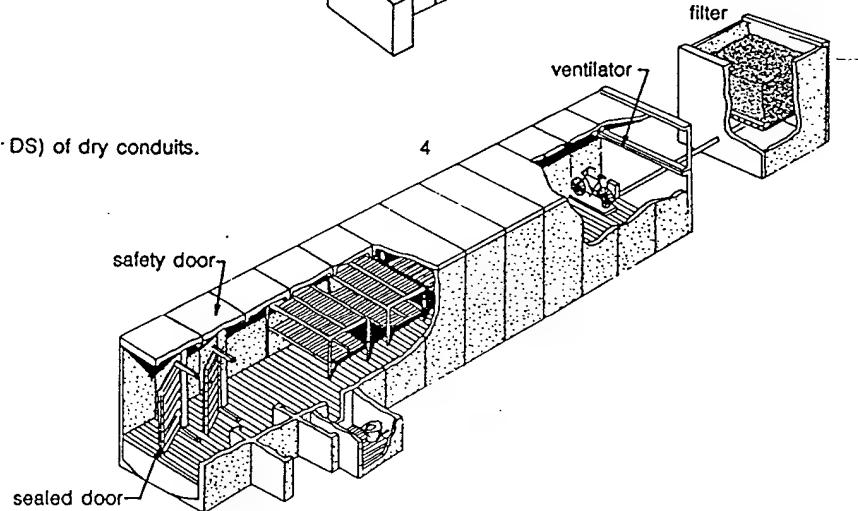
2. Shelter for 65 persons from blocks of dry conduits.



3. Shelter for 200 persons from three dimensional sections of main conduits (OMK-2.4 x 2.4).



4. Shelter for 100 persons from slabs (DP; DS) of dry conduits.



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Soviet publications and human sources have described the use of prefabricated, reinforced concrete structural components as emergency blast shelters to be assembled prior to an attack.

commission, which is responsible for coordinating the evacuation plan of the entire rayon.

#### Evacuation Procedures

44. Theoretically, the order to evacuate could be issued at any time. The 1977 civil defense textbook refers merely to actions to be taken upon the "announcement of a decision to carry out evacuation." Most sources agree, however, that the order to evacuate would be given in a period of threat of attack. Some human sources have also noted plans for evacuation after a nuclear attack as radiation levels permit movement from available shelters. The evacuation order is given by the national leadership and transmitted to local officials via the military districts, military commissariats, and civil defense staffs.

45. To carry out urban evacuation in the shortest possible time, the order would be disseminated both through dedicated civil defense networks and the mass media. Upon receiving the alert, civil defense staffs and individual installations would implement their evacuation plans, using available communications to notify subordinate personnel of the time and place for staging their evacuations. Factories, offices, schools, or bus and train stations would serve as embarkation points. According to Soviet planners, and confirmed by human sources, the populations would probably have only a few hours to prepare for the evacuation following the order to evacuate. Upon arrival at the assembly points, people would board buses or trains, or begin walking toward assigned relocation areas. People destined for more remote regions would be evacuated to intermediate points where they would rest and be fed by local authorities.

46. The status of advance preparations for an evacuation varies. Students and personnel at economic installations are generally told about the existence of evacuation plans, but only a few know details. Many seem to know their evacuation areas, but are less certain about the extent of preparations.

47. There is no evidence that large-scale evacuation exercises involving the actual movement of thousands of people have been practiced. There is evidence, however, that small-scale evacuations are practiced several times a year at schools and economic installations in some urban areas. In a few instances, personnel are evacuated to reception areas, but in most cases they are dismissed after arrival at assembly points.

48. The modes of evacuation most frequently mentioned in Soviet sources are buses, trucks, trains, and walking. Transportation problems in terms of vehicle availability could arise, especially if a military mobilization took place concurrently (as would probably be the case). The transport of military personnel and equipment would require a large number of vehicles, although there is disagreement on the scope of their requirements.

49. Sources who have worked at motor vehicle parks have stated that a number of their vehicles were scheduled for civil defense use during mobilization.<sup>3</sup> Civil defense evacuation plans reportedly were practiced at least once a year, and included picking up some civilians at designated assembly points and transporting them to predesignated relocation areas. Breakdowns of vehicles or lack of spare parts would affect the total number of vehicles available, as would the timing of an attack.

50. In general, there would be severe demands on transportation resources during the period of an evacuation. This was probably a principal factor in the original Soviet decision to opt for the combined method of evacuation including walking. The latter method would also contribute flexibility to the task of military traffic controllers in circumstances where road congestion would also pose serious problems.

#### Preparations at Reception Areas

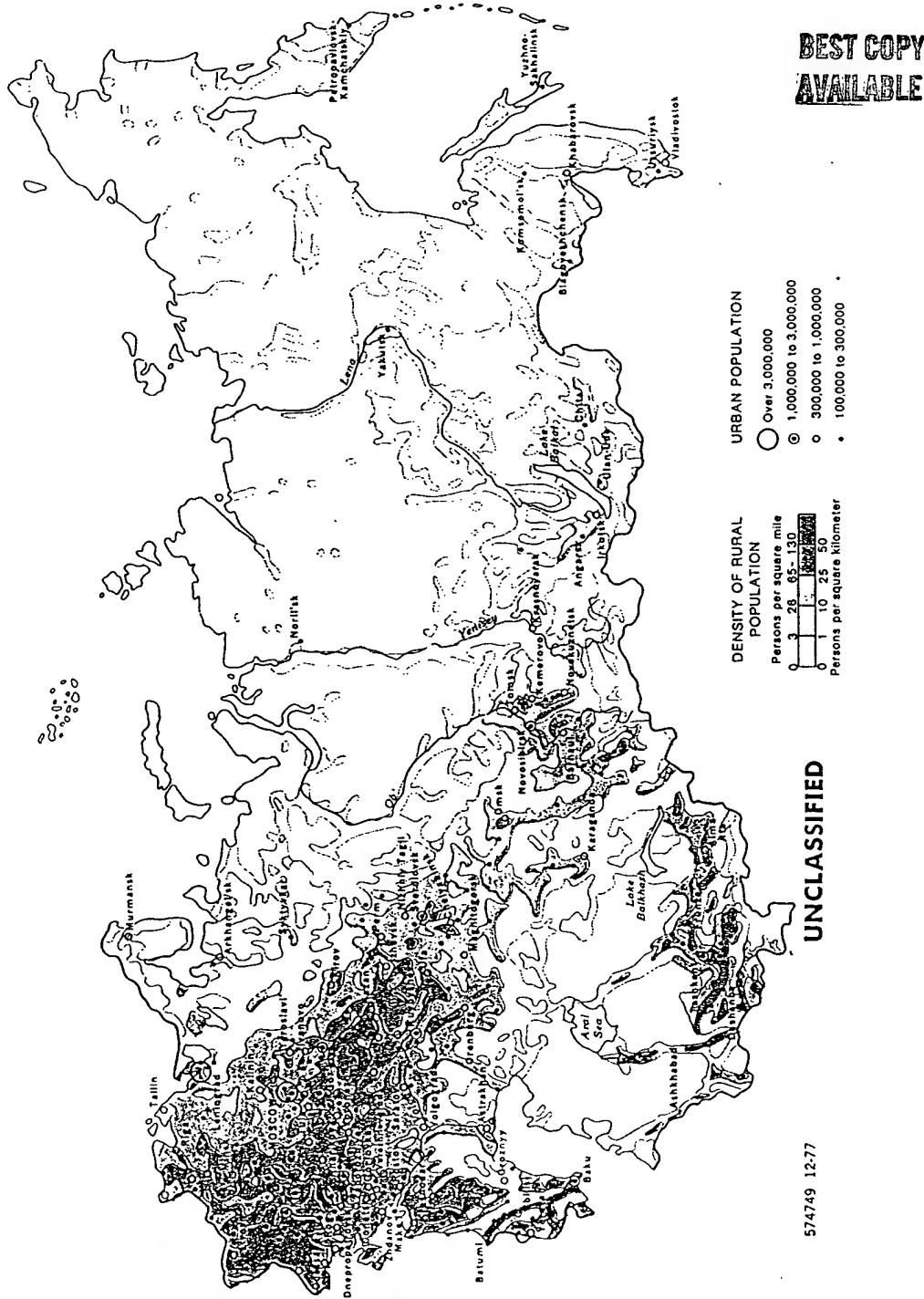
51. Soviet descriptions of preparations at reception areas are rather general but indicate that material requirements—food, water, shelter, and medical services—would be provided upon the arrival of evacuees. Civil defense staffs reportedly are to determine these requirements in formulating their evacuation plans and to acquire the necessary supplies and services for the evacuees. We have only limited information on the actual status of preparations at reception areas.

52. The Soviets intend to use all available space in rural homes and other buildings, including public buildings, recreational facilities, youth camps, and farm storage facilities. One Soviet manual recommends a hosting ratio of two urban evacuees for every rural inhabitant, although human sources had cited higher figures. We have not quantified the total amount of space available in existing rural structures

<sup>3</sup> The allocation of vehicles for an evacuation is the responsibility of the military commissariats which work closely with civil defense staffs in manpower allocations and in evacuation commissions.

Distribution of Population in the USSR

Figure VI-7



near all large urban areas. From our analysis of some areas, however, we believe that the availability of rural floorspace is not a factor limiting evacuation, particularly in most of the heavily populated regions of the USSR. (See figure VI-7.) For example, in the Kiev Oblast we found that the urban population could be redistributed throughout the rural region at an urban to rural hosting ratio of 2.2:1. At the same time, in remote areas such as Noril'sk and Komsomol'sk, where sufficient space is unavailable in existing rural buildings, additional accommodations would have to be provided. We have no information on steps taken in these areas to provide facilities for evacuees.

#### Effectiveness

53. A number of studies have been completed over the past year to evaluate the feasibility and effectiveness of Soviet urban evacuation using various means of transportation. These studies attempt to combine Soviet criteria for evacuation with geographic and other factors, in order to determine the extent to which Soviet guidelines can be followed and the rates at which the population can be evacuated. (See figures VI-8 and VI-9.)

54. The basic assumptions for these studies include:

- Twenty percent or more of the urban population comprise the "essential" personnel and their families who would be dispersed to areas within commuting distance of their places of work.
- Seventy percent or so of the urban population would be evacuated to points beyond the dispersal areas.
- Adequate housing in rural areas for evacuees would be available.
- Various modes of transport (buses, trains, automobiles, trucks, and walking) would be employed.
- Civil defense planning and training of cadres would be adequate for directing the evacuation.

55. Weather is also an important factor in carrying out an evacuation. Unusually severe weather conditions could slow the pace of evacuation. These conditions could be severe enough to affect a Soviet decision on whether to evacuate some areas. Soviet civil defense authorities in the areas affected would be expected to take such conditions into account in their plans and preparations. For example, they may reasonably adjust the allocation of transportation resources and alter their evacuation timetables. Other

factors which affect evacuation feasibility, such as the availability and distribution of fuel and confusion among the population, have not been evaluated.

56. The results of our studies indicate a range of possible evacuation rates depending primarily on the availability of different transportation modes. These studies generally confirm the conclusions reached in last year's IIM on Soviet civil defense concerning the feasibility of Soviet urban evacuation and the rates at which such an evacuation could take place. For evacuations employing motorized transport—buses, trucks, trains, and automobiles—we estimate that, from the time the evacuation order was given until the last group of evacuees reached reception areas, one to four days would be required to evacuate most Soviet cities of about 1 million people or less. Larger cities, such as Moscow and Leningrad, would require more than this time to evacuate, and cities with populations less than 100,000 could be evacuated within the lower bound above. Overall, we estimate that two to three days would be required to evacuate a major portion of the Soviet urban population. If, on the other hand, the evacuation were to be carried out on foot, a week or more could be required to evacuate the larger Soviet cities. It is more likely, however, that some combination of motorized transport and walking would be used, reducing the evacuation period to less than a week.

57. This estimate compares favorably with the Soviets' statements concerning the time required for evacuation. In 1970 their textbooks stated that evacuation would require 72 hours to accomplish, whereas the 1977 textbook reported time as 48 hours. These times are given as guidelines and can vary from place to place.<sup>4</sup>

#### C. Life Support

##### Availability and Distribution of Supplies and Equipment

58. *Food and Water.*<sup>5</sup> We estimate that the Soviet grain storage capacity is about 230 million metric tons (100 million on-farm and 130 million off-farm). According to Soviet sources, the total on-farm capacity of grain and oilseed storage facilities, which vary from open-air platforms and pits to well-ventilated, covered buildings, was about 100 million metric tons in 1973. At least 40 percent of Soviet grain is stored on the

<sup>4</sup> It should be noted that the Soviets also refer to a 48-72 hour time frame for the construction of rapidly erected blast shelters.

<sup>5</sup> Most of the conclusions in this section are unchanged from those in last year's IIM on Soviet civil defense.

farms, and most of the remainder is probably kept in rural areas. Off-farm storage was reported to be about 125 million metric tons. Off-farm facilities are usually covered, frequently ventilated, and are able to hold grain in good condition for several years. In the USSR, food storage and food processing are activities performed outside urban areas of greater than 50,000 population. While we have some information on other foods, we have concentrated our analysis on the availability of grain, because it is the staple of the Soviet diet.

59. Intelligence reporting consistently referred to the existence of food reserves, some in underground storage, throughout the USSR. Many buried or semiburied food storage facilities outside urban areas have been identified, but the number and capacities of these installations are not known, nor do we know how long the surviving population could be sustained on the undamaged stores after an attack.

60. In addition to the 36 underground grain storage bunkers identified last year, three large grain storage bunkers of another type have been identified near Leningrad and Riga, both non-grain-producing areas. They differ from the others only in that they are not colocated with aboveground grain storage. In Kiev, where other semiburied food storage bunkers were located north of the city, a human source stated that the food was to feed the evacuated population in that area. Other sources have reported the existence of other food storage facilities near major cities which they refer to as strategic reserves. We do not know the size of these reserves.

61. Civil defense plans also require that rural staffs and formations prepare for protection of livestock and growing areas from fallout. In Soviet writings, emphasis is placed on safeguarding the current harvest.

62. Evidence on the protection of sources of water supply dates back to the early 1960s. The program includes drilling wells, identifying aquifers, and building reservoirs. There are reports that these aspects of the program are being carried out. In addition, the Soviet practice of building underground or bunkered water reservoirs in the outskirts of cities will provide some protection against blast and excellent protection against fallout. Although we have little information on Soviet plans for large-scale purification of fallout-contaminated water, we know that in 1961 the Ministry of Health was tasked with developing proposals for methods of decontamination. However, radioactive particles settle out in a few days

or could be filtered out by a variety of expedient methods.

63. *Fuel.* Calculations of the storage capacity for refined oil products are as follows (in million barrels):

	Normal Stock Levels	Prestrike Capacity With 30 Days' Warning
Refineries and depots .....	240.8	321.1
Rail and tank trucks .....	19.4	38.9
Pipelines .....	27.0	27.0
Total .....	287.2	387.0
		(29-day supply) (40-day supply)

Thus, oil products in storage and transit would be enough to satisfy civilian, industrial, and military users at peacetime consumption levels for about one month. Coal stockpiles have been estimated at about 70 million metric tons. This is the equivalent of about 40 days' supply. Natural gas utilization in major urban centers would probably be disrupted and we cannot estimate how rapidly service to key users could be restored.

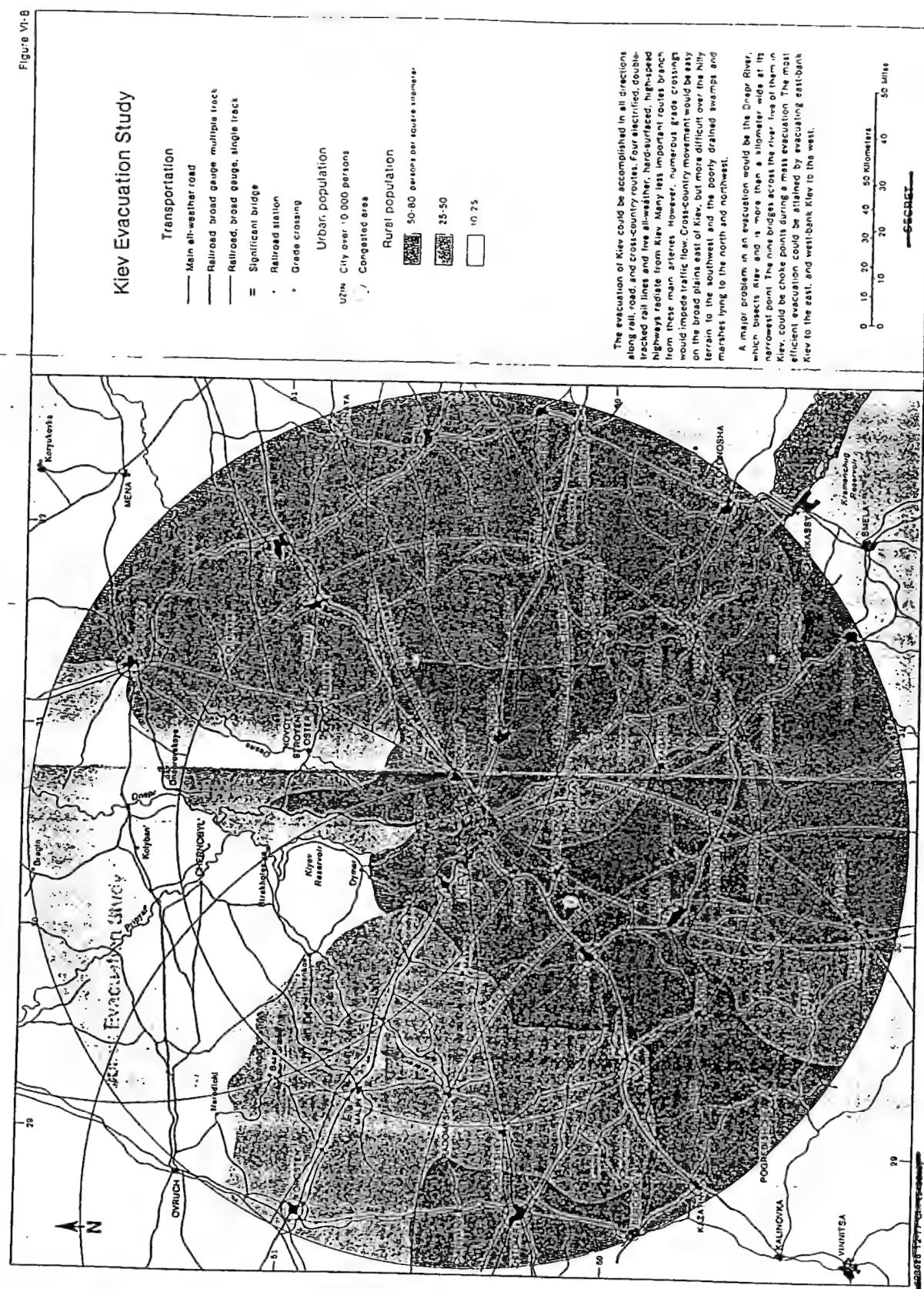
64. In any case the above figures suggest that supplies of oil products and coal would last for at least a month at prestrike consumption levels. If these levels were reduced by nuclear attack, or if damage to transportation facilities impeded even local distribution, these losses could be offset by energy conservation measures, alternate fuel sources, and a decrease in industrial demand. We believe, therefore, that sufficient stocks of fuel would be available in the post-attack period to sustain the needs of the surviving population.

65. *Individual Protective Equipment.* The basic items of individual protective equipment are masks, respirators, and protective clothing. For years, gas masks of various types have been produced and distributed, and the general population has been instructed in their use. Masks are not retained by the population, but are stored at work or in housing areas. Detailed instructions in civil defense manuals on how to fashion expedient masks suggests an inadequate supply of gas masks for rural inhabitants and nonessential urban residents. Special protective clothing—coveralls, head and hand covering, goggles, and boots—is normally available only to civil defense formations.

66. *Medical.* A characteristic of nuclear attack is that the numbers of surviving injured are expected to equal or exceed those killed by blast. This could mean

Figure 8

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Novosibirsk Evacuation Study

Transportation

- Main all-weather road
- Railroad, broad gauge, multiple track
- Railroad, broad gauge, single track

Significant bridge

Railroad station

Grade crossing

Urban population

TURBIA City over 10,000 persons

Congested area

Rural population

25-50 persons per square kilometer

10-25

less than 10

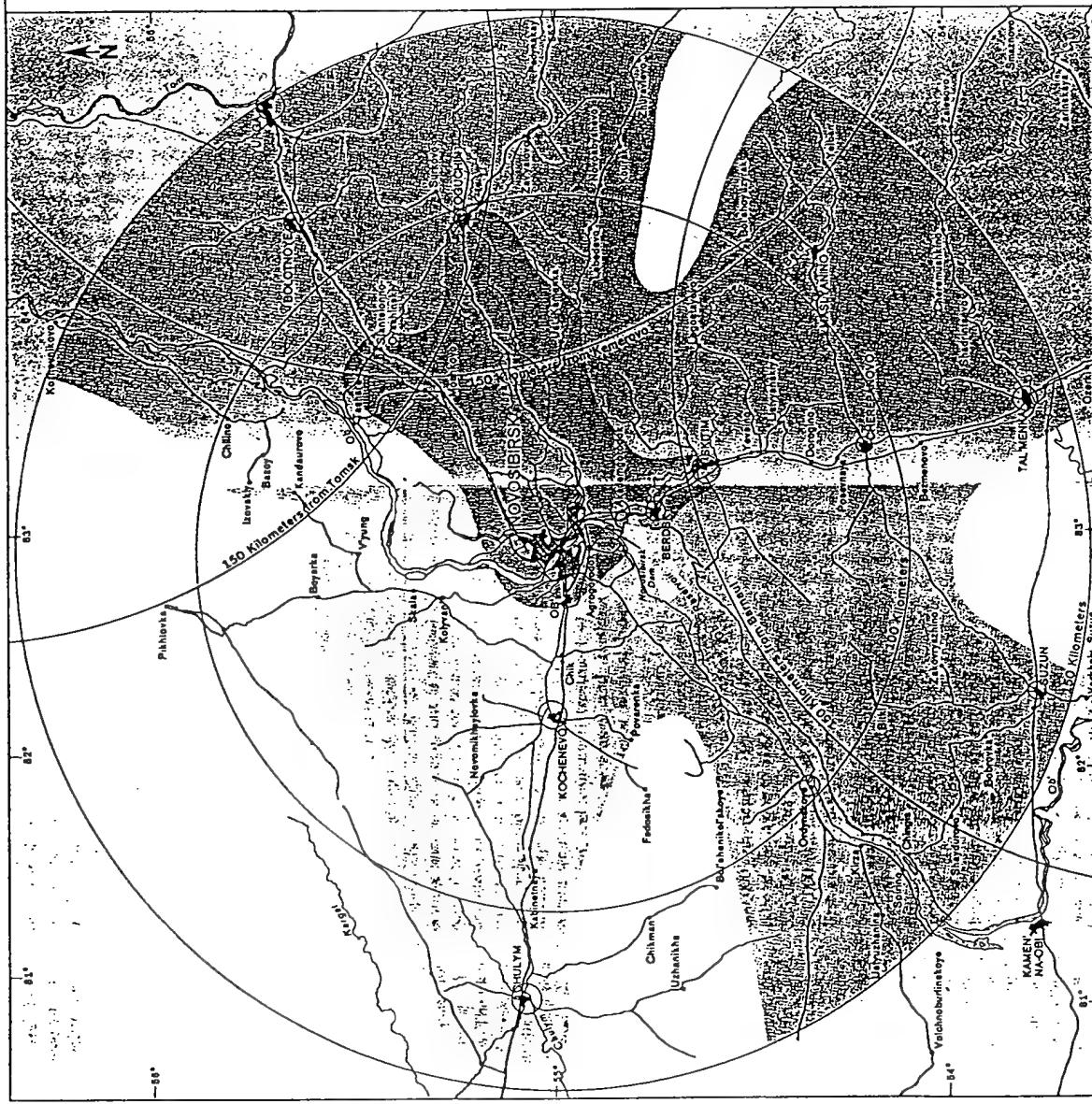
Evacuation from Novosibirsk could proceed in all directions by rail, road, and cross-country routes.illy land, streams, and ravines to the east channel movement into relatively narrow transportation corridors. The smaller west-bank section of the city open to a flat plain, where movement is less restricted. Swampy land restricts travel and accommodation possibilities at distances exceeding 60 kilometers to the northwest of the city.

few bridges cross the Ob River, which divides the city, and mass movement could probably proceed away from the river. Evacuation by ship would be unrestricted northward, but restricted southward by the Novosibirsk Dam.

Nearly all east road and rail routes have grade crossings or narrow underpasses, and surrounding settlements would contribute to traffic congestion. Evacuation farther than 100 kilometers to the north, east, and south may be impractical because of traffic and competition for accommodations by evacuees from other major cities (150-kilometer circles around them are shown on the map). Even without this competition, accommodations in the countryside would be limited because Novosibirsk contains about half the population of the area within 150 kilometers. Fuel is widely available in limited quantities at numerous fueling stations and rural vehicle parks.

0 10 20 30 40 50 Kilometers  
0 10 20 30 40 50 Miles

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tens of millions of injured survivors throughout the nation. In the immediate postattack period, treatment of trauma (wounds and broken bones) and burns creates the greatest demand for professional care by physicians and surgeons. There is no specific treatment for radiation sickness beyond bed care, cleanliness, and replacement of fluids. This can be provided by relatively untrained personnel. Proper treatment of injuries and burns, however, places a heavy demand on those who possess specialized medical skills.

67. A rather high incidence of shelters was found at hospitals and medical institutes surveyed in Kiev and Leningrad—more than 40 shelters identified at some 30 locations. At some of the hospitals, shelters are interconnected by tunnels, while others have shelter space probably in excess of requirements for patients or staff personnel. The apparent extra space could be for wartime emergency use, or for the protected storage of medical supplies or auxiliary equipment.

68. In addition to protection in place, the civil defense medical service has developed a plan for medical evacuation and treatment using the countrywide assets of the Ministry of Health. The plan is based on a two-stage evacuation and treatment system: first aid and emergency treatment in or near the focus of destruction, followed by evacuation to a specialized hospital outside the target zone.

69. The first stage of medical evacuation and treatment would be performed by mobile first aid detachments made up of physicians and paramedical workers from city and rayon health services, and first aid teams from factories and other installations. These are to be deployed to the edge of the "zone of light destruction." The detachments and their subordinate medical teams are to perform the full range of emergency lifesaving services, decontamination, provision of limited temporary hospitalization, and evacuation of casualties to hospital base areas.

70. While plans for the operation of detachments appear adequate, size and composition of units would vary from place to place depending on local assets. Their availability would depend heavily on whether there was sufficient time before an attack for medical units to make final preparations. The Soviets estimate that at least 50 percent of all casualties will require specialized medical care. The estimated handling and transit time of three to four days or so from the first-stage treatment centers to hospitals outside the target areas may result in 20 to 40 percent mortality among the seriously wounded requiring hospitalization who have not been stabilized prior to evacuation.

71. The second medical evacuation stage consists of delivering specialized medical care to casualties from the areas of destruction. This stage is to be located in the exurban zone and consists of expanding existing medical facilities to the maximum, converting buildings into hospitals, and deploying mobile tent hospitals of up to 300 beds. The combination of all such facilities is termed a hospital base. Soviet plans call for these bases to be located a safe distance from the urban target area(s) that it must serve. Each hospital base would manage two or more hospital collection points, and each hospital collection point is to provide up to eight types of specialized medical care which will be organized from existing medical assets.

72. The main hospital of the hospital base is essentially a general hospital with additional assets for fallout decontamination and shock treatment. In the event of mass casualties, it is these hospitals that are in the greatest danger of sudden overloading. The hospital base organization is well planned and comprehensive in scope, but is beyond the present capability of the Soviet Union to implement fully. The demands for highly trained manpower, specialized equipment, and essential drugs in the amounts required could not be met by the present Soviet medical system. An additional load on the medical system would arise from the need to arrange for the evacuation and continued treatment of patients at hospitals whose personnel and facilities will be converted to civil defense hospital bases.

73. Another important problem facing the Soviets in the operation of hospital bases concerns the number and quality of medical personnel. The Soviet medical establishment in 1975 was estimated to contain about 800,000 physicians<sup>6</sup> for a physician-to-population ratio of about one to 318.<sup>7</sup> In addition, there are about 525,000 doctors' assistants, 1,185,500 nurses, and 590,000 other medical workers capable of rendering first aid and other treatment during an emergency.

74. In addition to the individuals making up the formal medical establishment, there are more than a million members of civil defense formations who have received various levels of first aid training. Important in this group are the female graduates of institutions of higher learning who are required to take two years of civil defense nurses' training and receive civil defense mobilization assignments. On the level of the installa-

<sup>6</sup> This figure possibly includes military physicians but no hard data are available.

<sup>7</sup> In the United States, this ratio is about one to 620 (1972 figures).

tion formations, it is the first aid teams on whom civil defense authorities have concentrated their efforts.

75. At the level of nurses and doctors' assistants, the training in first aid is more advanced and includes selected aspects of trauma management as well as some practical training. At the physician level, except for specialists, in-service advanced training in the management of severe trauma often consists of a few hours of lectures with little advanced clinical cross-training. This places the average narrowly trained Soviet physician in a poor position to function effectively as, for example, a surgeon. The main burden for definitive medical care would fall on surgeons and other medical specialists who are in chronic short supply, thus representing a limiting factor in the Soviet ability to render definitive treatment to mass casualties. This situation could markedly reduce the Soviets' ability to treat serious casualties. On the other hand, human sources with experience in civil defense medical services have described the emphasis given to sorting the casualties in conformance with standard military medical practice. By determining which of the wounded are likely to recover following treatment, and which will not because of the severity of their condition, civil defense medical units will be able to limit the number of individuals requiring further treatment and medical evacuation.

76. Medical support must be provided in dispersal and evacuation areas. Personnel, supplies, and facilities for this service would be in addition to those serving the two stages of medical evacuation. We have not been able to determine the extent to which infectious disease outbreaks, possibly facilitated by radiation-induced suppression of the immune response, would pose a significant health threat to the evacuees.

77. There is little information on specific medical supplies prestocked at evacuation centers or relocation sites. Although it is believed that the USSR has extensive stockpiles of medical materials, the locations, item inventories, and number of days of supply are not known.

78. The lack of a breakdown of physicians by medical specialty prevents our determining how many physicians in the critical specialties would be available to provide the kinds of definitive treatment which will be required since total casualties could range as high as 120 million, including 60 million to 70 million

fatalities. The only data presently available that addresses the capacity of at least a portion of the Soviet medical establishment concern the results of simulations of nuclear strikes on tactically deployed troops carried out several years ago. In these exercises, all medical facilities in the strike zones became saturated within three or four days, and after two weeks or so the accumulation of untreated casualties reached well over 1 million. Such exercises indicate that the Soviets are aware of at least some of the deficiencies of their medical establishment to cope with a nuclear strike. However, we cannot estimate the maximum number of casualties that civil defense medical services could treat following a general nuclear attack.

79. In describing the limitations on the ability of the Soviet civil defense medical services to cope with the massive casualties which would occur in nuclear war, we conclude that the Soviets would not be able to provide all the treatment required although it has not been possible to quantify their shortfalls. It should be noted, however, that casualties would certainly reach levels which make it doubtful that the medical capabilities of any modern nation could be adequate to provide treatment to those requiring it.

80. *Distribution.* Providing for the distribution of essential supplies to an evacuated population in a postattack period would develop into a difficult problem for Soviet civil defense planners. As on-hand supplies of food, water, and fuel are exhausted, the available Soviet transportation system would be increasingly called upon to distribute stockpiles and reserves to the surviving population. In general, the survivability of the Soviet transport system will depend on those measures taken prior to an attack to protect equipment and personnel. Soviet civil defense planners have made preparations to disperse equipment; to establish stockpiles of rolling stock, emergency maintenance, and material; to organize civil defense services and formations in transportation enterprises; and to protect personnel through construction of blast shelters at critical points in the road and rail transportation systems. Nevertheless, the coordination of requirements with available supplies and transportation is a complex problem for Soviet planners even in peacetime, and we have difficulty in predicting the impact on Soviet preparations of a large-scale nuclear exchange. Therefore, disruption of transportation and communications, dislocation of people, and reduction of supplies and productive capacity could pose problems in the postattack period.

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Effectiveness

81. Given at least several weeks to build up reserves and distribute special supplies of food and fuel, the Soviets could probably provide adequate supplies to sustain the relocated and surviving urban population, but as the weeks progressed supplies would have to be distributed from stockpiles and reserves in other areas. Much of the required transport equipment would

probably survive even in an attack following little preparation, but coordination and control problems would limit its utility. Soviet civil defense medical preparations would be unable to cope with the levels of casualties which large-scale nuclear attack would inflict on the civilian population. Even if the medical services functioned according to plan, it is likely that a large portion of those injured or affected by radiation would become fatalities within a month or so.

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## Chapter VII

### OVERALL EFFECTIVENESS OF CURRENT DEFENSES

1. The likely outcome of a nuclear exchange is largely unknowable. Neither we nor the Soviets can make a precise assessment of the overall effectiveness of present civil defense preparations—or those planned for completion in the hours, days, or weeks preceding a nuclear attack—in reducing damage or enabling recovery from a nuclear exchange. We can, however, apply quantitative data on civil defense, drawn from evidence of the Soviet program, to the computer models by which measurements are made of some aspects of the interaction of US and Soviet strategic forces. The results of this type of interaction analysis *do not convey the overall effectiveness of civil defense; they only indicate the effects* of some quantifiable features of civil defense on the outcome of an analysis, assuming other values in the strategic equation remain constant. The results of interaction analysis are used by both the United States and the USSR to test the adequacy of their strategic forces; therefore, the degree to which such results are affected by civil defense measures is pertinent to both sides' perception of the strategic balance.

2. During the past year, interaction analyses have been conducted by several agencies to assess the effects of Soviet civil defense on calculations of the results of various types of US attacks, ranging from one following a "bolt-from-the-blue" Soviet attack, with all conceivable Soviet defenses assumed to be ready, to a massive US preemptive attack by fully generated forces against a relatively low level of Soviet civil defense readiness. The large number of scenario variables resulted in a wide spectrum of possible outcomes, some indicating that Soviet civil defenses could reduce industrial damage and fatalities to very low levels and others suggesting that the Soviet civil defense preparations would make little difference.

3. In our interaction analyses to assess the impact of Soviet civil defense we used our latest findings, extrapolations, and estimates of Soviet civil defense programs and activities and made a number of assumptions about the attack scenario and the state of Soviet preparations. Varying the assumptions used, our

analyses produced a range of outcomes. The results do not represent the "most likely" case, nor do they constitute a net assessment of the probable outcome of a massive nuclear exchange between the United States and the USSR. The absolute levels of damage on the USSR shown by our calculations are less important than the relative differences in levels of damage attributable to varying states of civil defense preparations. The results of these analyses are, however, only one measure of civil defense effectiveness. Other measures, on which our findings are largely subjective, are the effectiveness of the wartime civil defense organization and its command and control structure, levels of life-sustaining supplies and equipment likely to survive, the capabilities of transportation networks to distribute essential supplies and equipment, and the effectiveness of medical services.

#### A. Methodology and Assumptions

4. In our analyses of the effects of Soviet civil defense preparations on damage to the USSR we made the following assumptions for a worst case which conveys the more threatening end of the range of possible outcomes that would result from a single spasm attack:

- The only US weapons used were those that we calculate would survive a massive Soviet counter-force attack against US strategic forces in a day-to-day alert posture.
- The objectives of the attack [ ] were to destroy high-value economic and military targets in order to minimize Soviet capability to reconstitute the USSR as a major power. Specifically, our objectives were to destroy 80 percent of the economic value of industrial installations in the selected target list and to achieve 90-percent damage expectancy against selected military targets. Population was not specifically targeted.
- Approximately 3,700 weapons were used in the attack. These included all surviving Minuteman

and B-52 bomber weapons against military and hardened command and control targets. Poseidon weapons were allocated against economic targets. A force of 1,000 weapons—Polaris, Titan, FB-111, and Poseidon—was held in reserve. Forward-based systems were not included in the attack.

- Weapons allocated to military and leadership targets were ground burst when feasible; weapons allocated to economic targets were detonated at a height of burst to achieve maximum destruction of industrial facilities.
- The primary variable in our attack analysis was the level of readiness of Soviet civil defense preparations dependent upon the time available to make final preparations.

5. We have made some assumptions which would not likely occur in combination. Soviet efforts to maximize civil defense preparations would almost certainly be detected and lead the United States to place its forces at increased levels of readiness. In addition, the attack scenario assumes no effort on the part of the United States to compensate for Soviet civil defense measures such as retargeting, altering the height of weapon bursts, protracting the period of the attack, or reducing the number of weapons held in reserve. Moreover, if US forces were in a fully generated alert posture, additional weapons could be used to strike additional targets, to increase the level of damage expectancy, or to compound damage against selected Soviet military and economic targets.

6. The interaction analyses were conducted using computer models to simulate the results of US attacks on the USSR. (See annex D for a more detailed explanation of the analyses.) These analyses included the following steps: development of a comprehensive list of Soviet military and economic installations [ ] allocation of US

weapons against targets selected from that list; and optimization of the effects of these weapons against these targets. The results of this analysis were used in an evaluation of fatality and casualty levels produced by the weapon laydown (for prompt nuclear effects and fallout only) for various Soviet civil defense postures using the SIDAC model.<sup>1</sup> Some of the more common problems associated with analyses of this type are as follows:

[ ]

<sup>1</sup> The models employed in analysis are maintained by the Defense Communication Agency's Command and Control Technical Center.

[ ] The target data base employed in our analyses included approximately 70 percent of the economic value<sup>2</sup> of the Soviet Union and a larger percentage of the economic value of those industries considered strategically most important.

- The US attack was formulated to maximize damage to Soviet military and industrial targets, but weapon allocations generated by this method do not correspond to actual US planning. While this attack does not consider many of the operational factors that are covered in highly sensitive US plans, it does provide a reasonable basis for evaluating the relative effects of civil defense measures on the levels of casualties which could result from a massive nuclear exchange.
- The damage criteria used for Soviet industry are primarily for structural damage and do not fully account for measures to protect machinery and equipment.

7. Several studies were undertaken in the past year which assess in greater detail the local effects of civil defense measures in the Kiev and Gor'kiy oblasts. These studies examined such Soviet programs as evacuation, dispersal, industrial hardening, and urban shelters for a range of US attack scenarios. These analyses are probably more realistic than the aggregated analyses in their treatment of specific Soviet civil defense programs. While we did not extrapolate the findings from studies of only two relatively small areas to the entire country, the results of the studies were consistent with those of our aggregated analyses of simulated attacks against the USSR.

#### B. Readiness of Soviet Civil Defense

8. The amount of time available to implement planned procedures has a critical impact on the readiness of civil defense measures. In turn, the time available to make preparations would depend on Soviet decisions in the period preceding a nuclear attack. A decision by the USSR whether and to what degree to implement civil defense plans would be made in conjunction with decisions to alter the readiness posture of its military forces and could have a number of purposes, such as:

- To deter a US attack, to coerce the United States, or to show determination by visible civil defense preparations.

<sup>2</sup> Economic value is a composite of net output (manufacturer value added) and capital investment.

- To maximize civil defense preparations as a precautionary move made to put the USSR in the best possible position to conduct nuclear war should deterrence fail or should the Soviets decide to attack the US.
- To avoid provoking the United States into an attack or to avoid signaling Soviet intent to attack, by improving Soviet readiness through covert civil defense preparations.
- To strike a balance between improved readiness and surprise prior to a planned attack on the United States, by undertaking only certain civil defense preparations.

9. We have not attempted to judge how the Soviets would choose among conflicting requirements and risks in deciding when and to what extent to implement civil defense plans. We therefore cannot predict the extent of Soviet preparations based on the time available for carrying them out. For purposes of our analyses, we have listed below the preparations which we believe the Soviets could complete with varying amounts of time. The preparations listed are consistent with the Soviets' plans and our estimates of their capabilities, but are not related to any particular Soviet purpose or preattack scenario. We have categorized the preparation periods as follows: two hours or less, minimal preparations; a day or less, limited preparations; two to three days, moderate preparations; and a week or more, extended preparations.

#### *Minimal Preparations (two hours or less)*

- Key leaders would be protected by evacuation or in-place shelters.
- Some lower echelon leaders could reach exurban shelters, those who did not would use in-place or best available shelter.
- Shelters for the urban population could be occupied, but few would be fully stocked and ready for occupancy.
- Some rapid shutdown is possible, but no hasty hardening at industries would take place.
- Military civil defense regiments would be deployed to designated stations but not augmented by reservists.

#### *Limited Preparations (a day or less)*

- Key national leaders and a large portion of the lower echelons of leadership would reach exur-

ban shelters. Other lower echelon leaders would occupy their designated urban shelters.

- A portion of the essential personnel would be dispersed and sheltered. From 10 to 20 percent of the urban population probably would be accommodated in hardened urban shelters.
- There would not be time for evacuation of the remainder of the urban population; they would have to seek best available shelter in offices, residences, and other structures, some of which could be upgraded to provide increased protection.
- Some preparations for hasty hardening of industry would be made and many rapid shutdown measures would be taken.
- Military civil defense regiments could be partially augmented and deployed to designated stations.
- Other measures such as expedient shelter construction, and the emergency distribution of supplies could be initiated.
- Civil defense formations would be alerted and partially mobilized.

#### *Moderate Preparations (two to three days)*

- The leadership at all levels would have been relocated or otherwise sheltered.
- Dispersal of essential personnel would be completed.
- A major portion of the urban population would have been evacuated and provided with best available shelters in relocation areas (the number of people so protected would increase rapidly after the first day or two, although some cities would require more than a few days to complete evacuation).
- About 10 to 20 percent of the total urban population could be sheltered.
- The quality of protection provided by shelters would be upgraded, both in the cities and in rural areas.
- Emergency distributions of supplies, especially food and water, would be well under way if not completed.
- Protective equipment for individuals could be issued or improvised.

- The shutdown and hardening of industrial facilities would be implemented.
- Military civil defense regiments and civilian formations would be fully mobilized.

*Extended Preparations (a week or so)*

- Urban evacuation would be completed.
- Available shelters could be upgraded and expedient shelters in urban and rural areas could be constructed.
- The level of emergency stockpiles, their distribution and their survivability could be improved.
- The relocation of some selected facilities to dispersed locations could have begun.

**C. Effects of US Retaliation With Day-to-Day Alert Force**

**Leadership Protection**

10. Under most circumstances effective protection for the leadership at all levels could be provided. With only a minimal period for preparation, many lower echelon leaders may not be effectively protected. Those command posts and relocation sites that we identified and located would be vulnerable to US attack. The number of shelters for the leadership elements described in this paper is so great and their locations so widespread, however, that most would survive an attack such as that we have postulated. We assume, moreover, that the Soviets recognize the vulnerability of some installations and have made alternative arrangements at least for the top national leaders.

**Protection of the Economy**

11. Those measures we have described for the protection of the economy could not prevent massive damage. We were able to achieve our goal of destroying 80 percent of the economic value of those installations in the selected target list—or about 55 percent of the estimated total Soviet economic value. Even with a week or so of preparations, evidence of Soviet plans for industrial hardening indicates that there would be little reduction in the amount of prompt damage to facilities inflicted by blast. The Soviet measures for protecting the work force, critical equipment, and supplies and limiting damage from secondary effects could contribute to maintaining and restoring production after an attack. We have not, however, analyzed the Soviet potential for recovery.

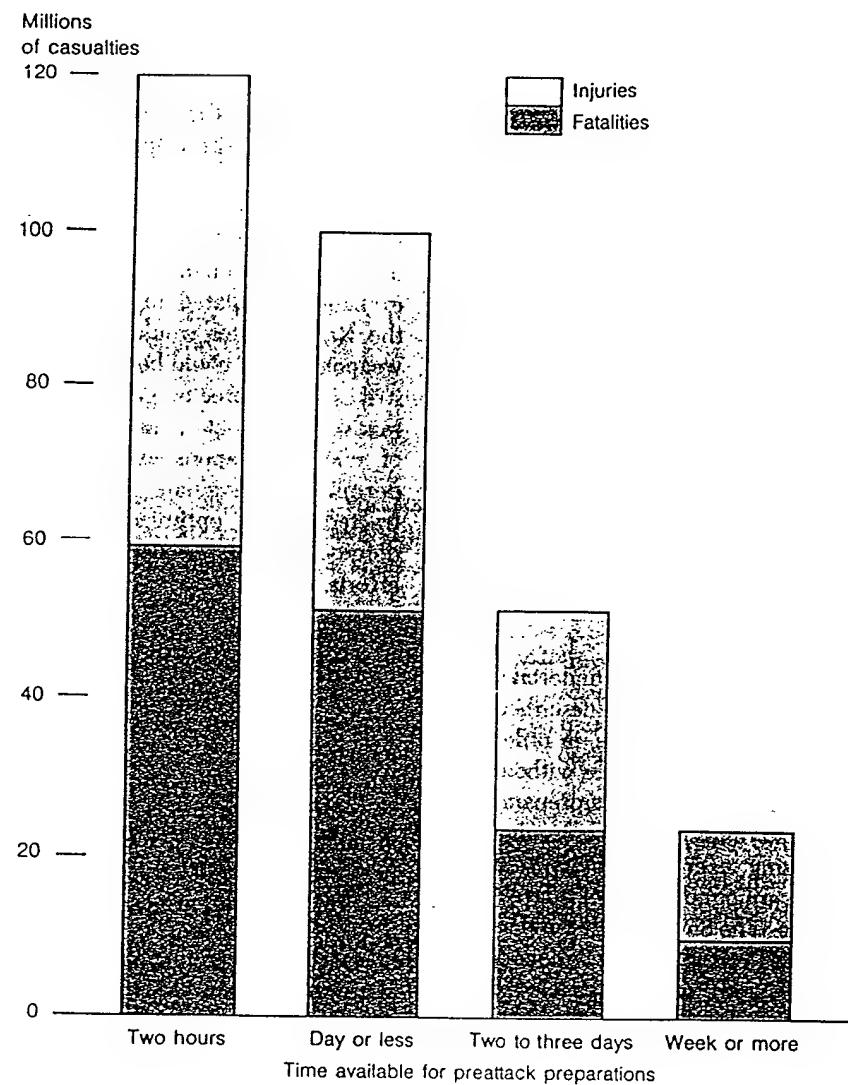
**Population Protection**

- 12. The extent of losses to the population would depend primarily on the time the Soviets had to prepare for an attack and whether or not they chose to evacuate their urban population. (See figure VII-1.)
  - With a minimal period of preparation (two hours or less) a massive US attack could result in casualties from prompt nuclear effects and fallout of in excess of 120 million, including 60 million to 70 million fatalities.
  - With limited preparations (a day or less) the Soviets could reduce the number of fatalities about 5 to 10 percent. Total casualties would still be in excess of 100 million people, of which the fatalities could be more than 50 million.
  - A moderate period of preparation (two to three days) during which the Soviet civil defense authorities implemented plans for evacuation of urban areas could reduce fatalities from the levels cited above to about 15 million to 20 million. Casualties, including fatalities, could be more than 50 million.
  - Extended preparation (a week or more) could further reduce the level of Soviet fatalities and casualties. With time to complete an urban evacuation, fatalities from prompt nuclear effects and fallout could range from 5 million to 10 million people with total casualties in excess of 20 million.
- 13. In general, even partial evacuation of cities could reduce urban fatalities and casualties from an attack against Soviet industrial and military targets. Evacuation alone could reduce the total number of Soviet casualties by a factor of two or three. Expedient shelters in rural areas for evacuees would reduce the expected number of casualties even further. We have analyzed the effects of urban shelters and evacuation on reducing casualties and fatalities from a retaliatory US attack on economic and military targets. Under optimum conditions, including time for evacuation, shelter protection for the entire population, and other final preparations, fatalities could range from 5 million to 10 million people, with total casualties in excess of 20 million. Considering the difficulty of carrying out an expedient shelter program on a wide scale, we do not believe the Soviets could be confident of achieving a reduction in fatalities to such low levels. With urban shelters and evacuation but without expedient shelters in rural areas, Soviet fatalities from a US attack against industrial and military targets could

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Effects of Civil Defense Preparations

Figure VII-1



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range from 15 million to 20 million people. Total casualties could be on the order of 50 million to 60 million people.

#### D. Effects of US Retaliation With Generated Force

14. We believe, as do the Soviets, that a nuclear exchange would most likely occur during a period of high tensions in which both sides recognized a high risk of general war. Under these circumstances, we would expect US forces to be in a fully generated posture.

15. Our appreciation of the effect of a US strike on Soviet military and industrial targets using a generated force, instead of the day-to-day alert force, is based on analyses done by other agencies. It is assumed that the increased number of weapons in the generated US force would be used to strike more targets and to compound the damage expectancy on the same targets that would be struck by the day-to-day alert force. We estimate that the increased weight of attack by the US generated force would increase Soviet casualties over those calculated above depending on the number and type of additional targets selected.

#### E. Alternate Options

16. Many variations on the postulated scenarios described above are possible. For example:

— The Soviets could seek covertly to undertake some of the civil defense preparations described herein, as well as military preparations, in order to achieve an increased level of readiness without alerting the United States. Civil defense preparations could include readying shelters, positioning supplies, and increasing exercise activity, but would rule out public announcements of a large-scale urban evacuation. The Soviets might undertake these preparations either as precautionary measures or following a decision to attack the United States. The results of a US attack would probably be similar to those postulated under the limited preparations case.

— On the other hand, the Soviets could deliberately delay even covert preparation of their civil defense in order better to conceal their intention to initiate a nuclear exchange or in the belief that such preparations might provoke a nuclear war which could still be avoided. In this event, they could protect a large portion of their leadership, but fatalities and casualties would be similar to

those for the minimal preparation case used in our analyses.

- Other attack scenarios could reduce the potential effectiveness of Soviet civil defenses. The Soviets might decide to carry out civil defense preparations overtly over an extended period. The United States, having been alerted by these activities, could respond by fully generating its strategic forces and target them to optimize both their potential for inflicting industrial damage and their fatality-producing potential.
- Alternatively, if the United States engaged in a protracted nuclear response to a Soviet attack, strikes against cities and economic and military targets could be spread out over a period of weeks or months rather than being concentrated in a single exchange. Even after the initial exchange postulated in our base case analyses, the United States would have more than 1,000 weapons which could be employed in subsequent strikes. A US force on generated alert could hold many more weapons in reserve. The limitations of nuclear weapons exchange models did not permit us to evaluate such scenarios, but protracted attacks optimized to offset Soviet civil defenses would seriously degrade civil defense efforts.

#### F. Implications of Interaction Analyses for Civil Defense Effectiveness

17. Interaction analyses provide indications of levels of damage to economic targets and numbers of surviving military forces of the two sides immediately after a nuclear exchange. Despite their limitations as measures of the overall effectiveness of civil defense, some useful implications can be drawn from such analyses:

- To reduce urban casualties significantly the Soviets would require two to three days.
- Increasing the number of weapons to raise the level of damage to individual military and industrial targets does not increase expected casualties significantly unless additional targets are attacked.
- Measures to disperse and harden industry which we observed and projected have little effect on expected damage levels from a US attack on economic targets.

- Changes in US targeting and weapon employment policies could increase the number of Soviet casualties depicted in our analysis measuring the effects of Soviet civil defense.

#### G. Uncertainties

18. Our interaction analysis and our assessment of the Soviet civil defense program contain large uncertainties. While there are remaining gaps in our understanding of the Soviet civil defense program, our collection and research effort of the past two years has gone a long way toward giving us a good understanding of Soviet civil defense plans and activities. The most critical uncertainties about Soviet civil defenses in post-nuclear-attack recovery operations apply to Soviet as well as US assessments of their effectiveness. Some of those uncertainties involve factors that are practically unknowable.

- The precise nature and timing of a nuclear attack and how it would occur.
- The nature and extent of all the secondary effects of nuclear weapons on people and facilities.
- The aggregate effects, both prompt and longer term, of a massive attack involving several thousand nuclear weapons detonated in a short span of time.
- The reactions of leaders, the military, and the general population under the circumstances attendant to a massive nuclear attack.

19. We also have uncertainties about some aspects of Soviet civil defense preparations.

- The length of time shelters could be occupied versus the length of time such protection would be required.
- The actual degree of protection against blast and radiation provided by these shelters.
- The extent to which hasty hardening measures and rapid shutdown could contribute to industrial survival and recovery.
- Prospects for a successful nationwide urban evacuation, and the length of time required to evacuate.
- The adequacy of fallout protection and housing for urban evacuees in rural areas.
- The prospects for successfully distributing supplies of food, water, and medicines nationwide.

- The survivability of transportation resources and their ability to function in the postattack period.
- The ability of Soviet communications to function effectively in the postattack period.

#### H. Summary of Effectiveness

20. We have summarized below the findings of our analyses and our judgments about measures of effectiveness of Soviet civil defense. Our interaction analysis indicates at best the magnitude of Soviet casualties and industrial damage immediately following a hypothetical nuclear attack. Our findings largely confirm the highly tentative conclusions in last year's IIM.

21. Judging by evidence of Soviet preparations, we conclude that under optimum conditions with several days or more preparations prior to an attack such as that we have hypothesized, Soviet civil defenses would:

- Assure survival of a large percentage of the leadership which would be necessary to maintain control over postattack operations.
- Reduce total population casualties to less than 10 percent (20 million).
- Contribute to maintaining and restoring production after an attack but not prevent massive damage to the economy.
- Improve Soviet capabilities to provide medical services, but not assure adequate medical treatment even for the minimum number of expected casualties.
- Improve the prospects of being able to distribute essential supplies to the surviving population.

22. With minimal time to make final preparations, we estimate that Soviet civil defenses would:

- Assure survival of many national and lower level leaders, but it would be doubtful that effective control over postattack operations could be maintained.
- Not prevent extremely high casualties estimated at about 50 percent of the total population.
- Permit adequate medical treatment for only a very small percent of the casualties.
- Reduce the prospects of sustaining the survivors.

23. The Soviets clearly view civil defense as an integral part of their military strategy, and they

apparently believe that continued development of their civil defense programs will improve the overall military posture of the USSR. They cannot have confidence, however, in the degree of protection their civil defenses would afford them, given the many uncertainties attendant to a nuclear exchange. We see no evidence that the Soviets have undertaken the development of a program that will embolden them deliberately to accept a higher risk of nuclear attack.

### I. Soviet Perceptions of Current Civil Defenses

24. The Soviet leaders do not view the effectiveness of civil defense preparations in isolation from other aspects of the strategic balance. Their view of the effectiveness of civil defense is probably tempered by changes of US strategy, tactics, capabilities, and weapon employment policies. They are evidently convinced that their civil defenses contribute to deterrence, to success in war, and to national survival should deterrence fail. We do not know what Soviet leaders actually think about how effective their current civil defenses would be in carrying out their mission. We base our view of their perceptions on their writings and statements and on evidence of their military and civil defense programs.

25. During the late 1960s the Soviets became concerned about how much warning of a nuclear strike would be available. Prior to that time civil defense planning was based on the Soviet conviction that a nuclear attack would be preceded by a period of warning sufficient to make final civil defense preparations. Since 1970, the Soviet civil defense program has been adjusted to take into account the possibility of a nuclear attack with little or no warning. However,

Soviet leaders are almost certainly pessimistic about the effectiveness of their civil defenses if they had minimal preparation time. On the other hand, they may not believe that nuclear attack with little or no warning is the most likely way nuclear war would begin. If they had time to implement their plan, Soviet leaders probably would be more optimistic about the effectiveness of their civil defenses.

26. Despite any uncertainties, the Soviet leadership considers civil defense to be an important element of the USSR's overall military strategy. The scope and continuity of these efforts, together with the results of our assessments of the potential effectiveness of the various civil defense programs, lead us to conclude that:

- The Soviets believe that their present civil defenses improve the USSR's ability to survive a nuclear attack from the United States, enhance their prospects for longer term post-nuclear-attack recovery, and contribute to Soviet chances to be in a stronger position than the United States after a nuclear exchange.
- At the same time, however, given the inherent uncertainties and difficult circumstances of a postattack environment, the Soviets recognize that such an exchange would pose a grave risk to their existing political, economic, and social system.
- They would expect, at a minimum, massive damage to the economy, including the destruction of many of their most highly valued material accomplishments. Under worst conditions, they would expect massive human casualties as well.

## Chapter VIII

### FUTURE TRENDS

#### A. Overall Trends

1. Our projections of future developments are largely subjective, because there is insufficient evidence about the Soviet program on which to base long-term trends. We do know that civil defense has historically received varying degrees of attention from the Soviet leadership. The program received new impetus in the late 1960s, and we believe it will continue at the pace that has been observed since then. We expect this to result in further improvements over the next decade.

##### Protection of the Leadership

2. Programs for the protection of the leadership are solidly established and well advanced. We are confident that this aspect of the program will continue to receive attention, with better protection for leaders at all levels. Soviet planners undoubtedly appreciate that major relocation sites and other shelters for the leadership are likely to become increasingly vulnerable, given the expected growth in the numbers, yields, and accuracies of US weapons during the next decade. Nonetheless, the continued growth in the numbers of facilities for leadership protection—many of which we will still be unable to locate precisely—will increase prospects for survival of large numbers of Soviet leaders.

##### Protection of the Economy

3. Prospects for the improvement of measures to protect the economy are mixed. The entire question of industrial protection requires further study.

4. We see little likelihood of any significant change in the overall pattern of industrial dispersal over the next decade. Even if the Soviets were to apply their civil defense criteria rigorously to all new construction, the change in the overall pattern would be gradual. In addition, the same economic and political factors that have driven the pattern of Soviet industrial development will almost certainly continue to hold. This creates strong pressures that are in opposition to the

preferred pattern from a civil defense standpoint. To alter this general pattern significantly the Soviets would have to undertake a massive relocation of existing industries, and we doubt they would undertake such a radical move during the next decade, particularly since we believe the Soviets will be confronted with increasing economic difficulties.

5. Industrial protection measures are likely to continue to be implemented selectively, giving priority to those facilities most important to defense production and to recovery. We need to learn more about the extent to which they have already built underground production capacity at existing facilities. Shelter building is expected to keep pace with the construction of new facilities and with the expansion of existing plants. Measures to harden structural components and facilities, especially those which could be undertaken as part of new industrial construction or modernization, may be more widely applied than has been the case to date. Rapid shutdown methods, with reduced times for their implementation, are likely to remain an important aspect of the program. There are many techniques for hasty hardening which the Soviets could develop for particular categories of industries and types of equipment if they chose to do so. Evidence to date does not show the Soviets moving in this direction. In general, we expect them to concentrate on those measures that would have the most effect primarily in easing the longer term task of reconstitution of the economy.

6. The Soviets have recently placed increased emphasis on organizing and training civilian civil defense formations, and we expect this trend to continue. If it does, the result should be a general improvement in the quality of such units and in Soviet postattack recovery capabilities. We would expect, however, that negative attitudes within civilian formations and the population generally will be of continuing concern to civil defense authorities. We also expect some improvement in the training and state of readiness of military civil defense regiments. While we do not project any major change in the size or composition of

these forces, there may be additional military civil defense units that we have not yet identified.

7. In sum, we expect some improvements in the level of protection for the economy, but any radical change in its vulnerability to nuclear attack is unlikely. We continue to be unable to quantify the level of Soviet preparations in this area, however. To do so we require additional information and further analysis.

#### Protection of the Population

8. The most significant change in Soviet capabilities is expected to be in the means of protection of the population—the nonessential portion of population as well as essential workers. The main improvement probably will be an increase in the ability to provide in-place protection of urban target areas. If the Soviets maintain their post-1968 trends of construction, the number of in-place shelters would increase by roughly two-thirds over the next 10 years. This would indicate that the current capability to shelter at least 10 to 20 percent of the urban population would increase to at least 15 to 30 percent.<sup>1</sup> This projection does not reflect possible shifts in the pace of shelter construction which could be prompted by changes in the Soviets' perceptions of the range of contingencies against which they must plan. For example, they might give less emphasis to shelters in urban areas if the survivability of US and Soviet strategic forces were such that neither side had a military advantage in striking first. Barring such major changes in the strategic balance, we foresee a steady program of improvements to expand shelter protection for residents of urban target areas.

9. We estimate that over the next 10 years, the percentage of population sheltered will increase, but the absolute number of people that would have to be evacuated will also increase because of growth in the urban population. To avoid an increase in the number of people to be evacuated, Soviet shelter construction would have to be higher than the rate we have projected. Thus, the Soviet leaders' critical problem of deciding whether to evacuate, and when to do so, will not change substantially over this period. They may, however, be able to achieve some reduction in the time required to evacuate by increasing the available transportation.

<sup>1</sup> See annex E for methodology of calculations.

#### B. Soviet Expectations

10. There remains the question of overall Soviet goals and expectations for civil defense efforts over the next decade. Since we lack direct evidence on these matters, our conclusions necessarily reflect our general perceptions of Soviet society as well as the extent of our knowledge of actual Soviet programs and fragmentary information on expressed views of the leadership.

11. Soviet expectations for progress in civil defenses over the next decade would be tempered by forecasts about increasing US offensive capabilities, as well as inherent uncertainties about civil defense effectiveness. In this respect the Soviets have expressed concern over US attention to their civil defense efforts. They probably expect steady improvement in the effectiveness of their defenses, and may believe that such improvement will be necessary simply to keep pace with the increasing power of US offensive forces. We believe the Soviets' goals for their civil defense program over the next 10 years are:

- To maintain or improve the already substantial degree of protection afforded to the leadership.
- To reduce the amount of time necessary to implement population protection measures, thereby expanding their options and improving somewhat their confidence in the efficacy of these efforts.
- To maintain and possibly improve effectiveness of civil defense formations in limiting damage from secondary effects and in carrying out repair and restoration operations.

12. The Soviets' basic goals will continue to be the survival of the Soviet system and recovery from the devastation that would be inflicted by a nuclear exchange. The Soviets believe that these goals are difficult but by no means impossible to attain. It is emphasized, however, that they see their civil defense objectives in relative terms: the Soviets seek to *reduce* the consequences of nuclear warfare and to *improve* their postattack posture—they do not see any way to *prevent* massive damage.

## Annex A

### METHODOLOGY FOR MANPOWER ESTIMATE

#### A. Background

1. The November 1976 Interagency Intelligence Memorandum entitled *Soviet Civil Defense* (NIO IIM 76-041) estimated that the Soviet civil defense effort involves nearly 50,000 full-time civilian and military personnel. The report states that this is a minimum figure which excludes full-time workers at nonmilitary organizations.

2. A new research effort intended to fill in the known blanks in the previous estimate and to update earlier data indicates that the Soviet civil defense structure includes about 117,000 full-time military and civilian workers. The bulk of the increase reflects

the inclusion of civil defense workers who previously were not counted because of a lack of data. These additional full-time civil defense workers serve at factories, scientific institutes, schools, and public organizations and enterprises. The remainder of the increase represents adjustments to earlier data.

#### B. Comparison of the Estimates

3. The old and the new estimates are compared in table A-1. (The old data are shown in parentheses.)

#### C. Methodology

4. The following statements discuss the methods used to derive the manpower data noted in table A-1.

Table A-1

#### Estimated Full-Time Soviet Civil Defense Workers<sup>1</sup>

	Military	Civilian	Total
Staff organizations			
National .....	250	(250)	300
Republic .....	2,250	(330)	2,700
Oblast .....	4,600	(1,200)	9,200
City .....	1,660	(1,600)	12,790
Rayon .....	1,080	(3,000)	16,180
<i>Total</i> .....	<i>9,840</i>	<i>(6,380)</i>	<i>41,170</i>
Military units			
Military districts .....	400	(400)	480
Civil defense troop units .....	26,500	(17,000)	26,500
Communications troops .....	900	(600)	900
Military academy .....	400	(400)	400
<i>Total</i> .....	<i>28,200</i>	<i>(18,400)</i>	<i>28,280</i>
Nonmilitary organizations			
Factories .....		33,500	33,500
Scientific institutes .....		2,700	2,700
Schools .....	3,000	(0)	5,700
Cooperative and public organizations .....		2,100	2,100
Housing and public utilities .....		3,500	3,500
<i>Total</i> .....	<i>3,000</i>	<i>(0)</i>	<i>47,500</i>
<i>Total</i> .....	<i>41,040</i>	<i>(24,780)</i>	<i>75,910</i>
			(10,050)
			116,950
			(34,830)

<sup>1</sup> Numbers in parentheses (old estimates) do not include the administrative and support personnel covered in the new estimates.

### Staff Organizations

5. Data regarding numbers of administrative and support personnel employed at staff organizations are extremely limited. On the basis of a single report which states that the Riga Municipal Civil Defense Headquarters has a staff of 10 professionals and two clerks, it was decided that 20 percent would be added to the IIM total to account for civilian administrative and support personnel at organizations where it is known that these additional workers should be added.

6. *National Staff*. There is no basis for changing the IIM estimate of 250 military personnel at this level. The number represents a collective "best estimate" on the part of the IIM working group and is reasonable. Fifty civilian administrative and support personnel have been added reflecting the 20-percent factor noted above for a total of 300 full-time civil defense workers at the national civil defense headquarters.

7. *Republic Staffs*. One report gave the manning at the Armenian SSR civil defense headquarters at Yerevan as 150 military personnel and 30 civilians. These figures were used for all 15 republics and are assumed to include staff and administrative personnel.

8. *Oblast Staffs*. There is only one known report on oblast civil defense manpower: the Magadan Oblast civil defense staff was authorized 63 slots as of May 1972. Because it is a data point, however, it was used in our estimate to extrapolate to the other 146 oblasts, krays, and autonomous republics. This results in a total manning figure at this level of 9,200. On the basis of another report, this number was divided evenly between civilian and military personnel.

9. *City Staffs*. Full-time civil defense personnel at city and urban settlement staffs are estimated at 12,790. While evidence was scant, five human source reports provided the basis for our estimate. Table A-2 shows the number of Soviet cities and urban settlements as of January 1974, the estimated number of full-time civil defense workers per city in each size grouping, and the estimated total number of military and civilian civil defense workers.

10. *Rayon Staffs*. Based on six reports, an average of two military and eight civilian civil defense workers, including administrative and support personnel, are estimated to be employed full time at each of the 538 urban rayons. A single report stated that the Maloyaroslavets Rayon has three retired military officers or full-time civil defense workers. This figure was used as the average for rural rayon staffs and results in a total of 10,800 full-time civil defense workers, including administrative and support personnel at this level. The total personnel figures for all rayons—urban and rural—are estimated to be 15,100 civilian and 1,080 military.

### Military Units

11. *Military District Headquarters*. The manpower estimate for military district headquarters was increased by 80 civilian workers to account for five civilian administrative and support personnel at each of the 16 district headquarters (again reflecting application of the 20-percent factor).

12. *Civil Defense Troop Units*. Troop unit manpower estimates were increased by about 9,500 men—reflecting the addition of 10 civil defense regiments to an earlier total of 26 and an increase in estimated average manning from 655 to 690. Thirty-nine docu-

Table A-2

#### Full-Time Soviet Civil Defense Workers in Cities and Urban Areas

City Size	Number of Cities	Number of Full-Time Civil Defense Workers Per City		Total Full-Time Civil Defense Workers	
		Military	Civilian	Military	Civilian
Under 3,000 .....	1,115	—	—	—	—
3,001-5,000.....	1,040	—	1	—	1,040
5,001-10,000.....	1,502	—	1	—	1,502
10,001-20,000.....	973	—	2	—	1,946
20,001-50,000.....	618	1	4	618	2,472
50,001-100,000.....	213	2	8	426	1,704
100,001-500,000.....	203	2	8	406	1,624
More than 500,000 .....	35	6	24	210	840
Total .....	5,699			1,660	11,128

ments were used in the analysis underlying these revisions.

13. **Communications Troops.** The manpower estimate for communications troops was increased from 600 to 900 on the basis of a report which states that the communications unit at the headquarters of the Armenian SSR includes 60 people. This number is used for all 15 republics.

#### Nonmilitary Organizations

14. The number of full-time civil defense workers per factory, school, or public service unit is a function of the size of each organization. Human source reports reflect a diversity of opinion regarding the minimum size of an installation in order for it to have a full-time civil defense staff. Analysis of these data indicates that there is at least one full-time civil defense worker for each plant having between 300 and 1,000 employees; that these full-time workers have part-time assistants, and that part-time civil defense workers serve alone in some smaller installations. This analysis provided the basis for the estimates of the total number of full-time civil defense workers in nonmilitary organizations.

15. **Factories.** The nearly 50,000 factories in the USSR were separated into categories according to work force size. The following tabulation shows this breakdown by number of factories according to data found in *Narodnoye Khozyaystvo SSSR (USSR National Economy)* for 1973. In addition, an estimate of the number of full-time civil defense workers at each factory and a total figure are given.

Size of the Work Force	Number of Factories	Number of Full-Time Civil Defense Workers Per Factory		Total
		Workers Per Factory	Total	
Under 100	17,003	—	—	
100-199	9,521	—	—	
200-499	11,124	1	11,124	
500-999	5,489	1	5,489	
1,000-2,999	4,081	2	8,162	
3,000-9,999	1,214	6	7,284	
10,000 and above	146	10	1,460	
Total	48,578		33,519	

The 33,519 full-time civil defense workers, divided by the 32,875,000 industrial workers in the Soviet Union,

yields a ratio of approximately one civil defense worker for every 1,000 industrial workers.

16. **Schools and Public Service Units.** This ratio of one civil defense worker per 1,000 industrial workers was applied to organizations in the following tabulation on the basis of the knowledge that they include full-time civil defense workers and on the assumption that these workers exist in the same ratio as at industrial plants.

	Number of Workers Per Organization	Estimated Number of Full-Time Civil Defense Workers
Scientific institutes (excluding schools)	2,726,000	2,726
Specialized secondary and higher educational institutes	5,700,000	5,700
Staffs of state and economic administrative agencies and bodies, administrative bodies of cooperative and public organizations	2,087,000	2,087
Housing, public utilities, and everyday services to the public	3,527,000	3,527
Total full-time civilian defense workers at schools and public service units		14,040

With the exception of about half the civil defense workers at schools—who are estimated to be military personnel—the above classes of civil defense personnel are estimated to consist entirely of civilians. Human source reports state that these workers are either retired military personnel assigned to these organizations, or that they are employees of the organizations whose duties consist entirely of civil-defense-related work.

17. In combination, the preceding methodologies support an aggregate estimate, which is detailed in table A-1, of 116,950 full-time civil defense workers, of which 41,040 are military personnel and 75,910 are civilians.

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## Annex B

### ANALYSIS OF DATA FROM KEY RECOVERY INDUSTRIES AND MILITARY-RELATED INDUSTRIES

#### A. The Data Base

1. Detailed studies of civil defense measures at 150 Soviet industrial plants selected from 17 key recovery industries and at 113 plants from five military-related industrial categories were conducted over the past year.

These categories and summary results are given in tables B-1 and B-2.

2. The first column of tables B-1 and B-2 lists the number of plants examined within each category. The second column indicates the total number of such plants in the USSR.

Since plants differ in size, the third column lists the fraction of total capacity included in the sample.\*

3. The last three columns of tables B-1 and B-2 present the overall results of the survey: the number of shelters identified, available total floorspace in these shelters, and the estimated square meters of shelter area per crisis worker.<sup>b</sup> This estimate was obtained using two-thirds of the shelter area calculated from the exterior dimensions.<sup>c</sup> The last column of tables B-1 and B-2 lists the square meters of shelter area per worker. This number is the ratio of the total available shelter area for those plants sampled within each category to the total estimated crisis work force.

Incomplete, but, for the most part, installations not included are either small in size or belong to a nonstrategic category.

\* Since the sample included some of the largest installations in each category, this fraction is larger than the fraction of plants sampled.

<sup>b</sup> The number of crisis workers at an installation is defined as one-half the estimated work force at each plant.

<sup>c</sup> The uncertainty involved in the estimates of the exterior dimensions of shelter areas may be significant. Calculating two-thirds of the exterior area of a shelter implies that an interior dimension (e.g., length) of a shelter is 82 percent of the exterior dimension.

#### B. Limitations and Restrictions on the Analysis

4. The available data impose several limitations and restrictions on the use and interpretation of the estimates.

— The imprecision in the estimates of the available shelter area and the crisis work force, while unavoidable, clearly limits the strength of the inferences to be drawn.

Identification problem will result in an underestimation of the Soviet civil defense effort.

— Because of time and manpower constraints, the number of plants sampled is small within each category. This lessens the degree of confidence that can be placed on the estimates of civil defense activity at all plants in those categories in the USSR.

— For some categories, the sampled plants are representative of the totality of all such plants in the USSR. For example a sample of only large plants in a particular category will bias any projections made to all such plants, if the size of a plant is related to the presence and level of civil defense activity.

— Projections from the sampled plants can be made only for the industrial categories used in the survey and only for those plants listed.

These limitations reduce the usable key economic recovery categories from 17 to 10 or 12 and military-related categories from five to three.

#### C. Percentage of Crisis Work Force Protection

5. Table B-3 summarizes the estimated percentage of the crisis work force which could be accommodated in the identified shelters, assuming two different occupancy factors (0.5 and 1 square meter per worker).

Table B-1

## Survey of 17 Key Soviet Recovery Industries

Category	No. of Plants Surveyed	No. of Plants in USSR *	Fraction of Total Capacity Sampled	Available Floorspace (sq meters) *	Area Per Worker *
Aluminum .....	5	14	.47	6,531	1.06
Bearings .....	5	19	.39	3,200	.17
Cement .....	15	96	.24	1,327	.20
Chemical .....	18	Unk	Unk	41,136	.78
Communications equipment ...	9	74	.27	5,602	.36
Computers .....	6	Unk	Unk	0	Unk
Electrical equipment .....	11	Unk	Unk	4,634	.13
Electrical power (w/o hydro) ..	10	410	.08	4,697	.43
Engines .....	5	12	.88	2,802	.12
Iron and steel .....	12	87	.51	23,595	.12
Machine tools .....	13	103	.28	1,186	.04
Motor vehicles .....	5	24	.32	46,938	.36
Nonferrous (w/o aluminum) ...	7	28	.45	1,570	.13
Pharmaceuticals .....	3	Unk	Unk	881	Unk
Petroleum .....	12	46	.38	5,790	.17
Synthetic rubber .....	4	14	.40	2,695	.29
Transportation (w/o motor vehicles) .....	10	Unk	Unk	9,285	.09
Total .....	150	927		161,569	.24

\* We have allocated two-thirds of shelters for personnel, since we know that roughly a third of the floorspace is taken by life support equipment and supplies.

\* Calculated using estimated number of crisis workers.

Table B-2

## Survey of Five Soviet Military-Related Industries

	No. of Plants Surveyed	No. of Plants in USSR *	Fraction of Total Capacity Sampled	Available Floorspace (sq meters) *	Area Per Worker *
Missile production .....	77	77	1.0	Unk	Unk
Ball bearing .....	15	15	1.0	Unk	Unk
Chemical warfare (suspect) ....	6	Unk	Unk	10,447	1.55
Biological warfare (suspect) ...	7	7	1.0	3,108	Unk
Armor and motor vehicles ...	8	Unk	Unk	71,076	Unk
Total .....	113				

\* We have allocated two-thirds of the total floorspace of shelters for personnel, since we know that roughly a third of the floorspace is taken by life support equipment and supplies.

\* Calculated using estimated number of crisis workers.

Table B-3

## Shelter Capacity at Selected Economic Recovery Plants

Occupancy Factor	Number of Plants by Percent of Crisis Work Force Protected				Total Number of Plants
	100%	50-100%	0-50%	0%	
0.5 sq meter per worker	30	18	39	54	141
1 sq meter per worker	11	19	57	54	141

If an occupancy factor of 1 square meter or more per worker is used then there are very few plants (less than 8 percent) which could accommodate the entire crisis work force.

6. Combining all the key recovery industrial categories for which there is sufficient information—that is, 15 out of 17 categories—the average available shelter area per crisis worker is 0.24 square meter. Thus, it is estimated that for those categories, 48 percent of all crisis workers would be sheltered at 0.5 square meter per worker; 24 percent of all crisis workers would be sheltered if the occupancy factor was 1 square meter per worker. These estimates do not take into consideration the unknown number of shelters within a reasonable geographic distance from a plant. Estimates including such shelters would, of course, result in an increase in the above percentages.

#### D. Estimates of Total Shelter Area for All Plants Within an Industrial Category

7. For 10 of the key economic recovery industries, it is possible to estimate, within confidence bounds, the total shelter area for all plants of that category in the USSR. The best estimates and the upper and lower estimates based on 90-percent confidence bounds are given in table B-4. One of the more disturbing results of this analysis, however, is the large variance of the plant population estimates. Often the upper 90-percent confidence bound is more than twice the projected USSR total.<sup>5</sup> Hence, most conclusions based on this sample should be considered tentative.

#### E. Estimates of Plants Within Each Category That Have At Least One Shelter

8. For 10 of the key economic recovery categories, it is possible to estimate the number of plants within each category that have at least one shelter (see table B-4). Because of the small sample sizes, the confidence

<sup>5</sup> These confidence intervals reflect only the error due to sampling, not due to misclassification or other sources. Thus, the true uncertainty is probably larger.

bounds on these estimates are large. However, aggregating across these 10 categories, it is estimated that 46 percent of the 395 plants in the USSR in these 10 categories have at least one shelter. A statistical analysis of these data indicates there is 90-percent certainty that the true proportion lies between 37 percent and 54 percent.

9. For three of the military-related industrial categories sampled, the percentage of plants with shelters was 67 percent, moderately but significantly above the 10 key economic recovery categories.

#### F. Soviet Strategy for Constructing Shelters at Industrial Plants

10. In addition to estimating quantitative measures of Soviet civil defense activity, the data have been analyzed in an attempt to identify those factors which might aid in explaining the Soviet program for constructing shelters at industrial plants.

11. One of the findings is that plants which have been constructed or expanded since 1968 are more likely to have shelters than plants for which construction or expansion occurred before 1968. Within 12 industrial categories, 80 percent of the plants with a major post-1968 expansion have at least one shelter. Of those older plants without a major post-1968 expansion, only 46 percent have at least one shelter. This difference is statistically significant, and reflects the Soviet policy of requiring that civil defense shelters be included in new construction.

12. Another finding is that the Soviets tend to protect larger plants more than smaller ones, where "large" is defined as a plant whose capacity falls in the upper 25 percent for its category. Across 12 categories, 76 percent of the "large" plants have at least one shelter, while only 40 percent of the smaller plants have at least one shelter. This difference is also statistically significant. Combining these two analyses, 89 percent of those plants that are "large" with post-1968 expansion have at least one shelter. Alternatively, only 25 percent of the plants

Table B-4

Available Shelter Area and Estimate of Plants  
With At Least One Shelter for 10 Industrial Categories

Category	Population	Estimate of Shelter Area (sq m)			Estimate of Number of Plants With At Least One Shelter		
		Best	90% Confidence Bounds		Best	90% Confidence Bounds	
			Lower	Upper		Lower	Upper
Aluminum .....	all 14	13,911	6,499	24,597	8 (60%)	3	12
Bearings .....	all 19	8,160	3,184	15,107	11 (60%)	4	16
Cement .....	all 96	8,448	1,760	15,135	32 (33%)	12	61
Communications equipment	29 largest	27,076	3,716	50,700	18 (63%)	6	28
Iron and steel .....	22 largest	46,420	30,398	62,442	22 (100%)	18	22
Machine tools .....	all 103	10,221	1,186	27,475	16 (15%)	2	50
Motor vehicles .....	all 24	225,300	46,938	438,000	24 (100%)	12	24
Nonferrous .....	all 28	3,457	1,570	6,514	8 (29%)	2	19
Petroleum .....	all 46	15,120	5,762	27,880	27 (58%)	14	38
Synthetic rubber .....	all 14	7,707	5,313	10,100	14 (100%)	7	14
Total .....	395	365,820	150,000 <sup>1</sup>	582,000 <sup>1</sup>	180 (46%)	145 <sup>1</sup>	215 <sup>1</sup>

<sup>1</sup> Approximate 90-percent confidence bounds for the total (that is, not merely the sum of individual 90-percent confidence bounds).

that are small with no post-1968 expansion were found to have at least one shelter.

13. Two additional statistical analyses were conducted to determine if any differences in civil defense activity among industrial categories and across geographic regions of the USSR could be due to sampling error alone. Using total shelter area as the measure of civil defense activity, only the chemical industry had a significantly higher average shelter area.

14. In order to examine for differences across geographic regions in the USSR, the country was divided into six regions obtained by combining the 18 economic regions of the USSR. The sample plants were

then allocated to the six regions and a test was made for differences in average shelter area among the regions. There was no statistically significant difference found and thus there does not appear to be any gross regional effect in civil defense activity at industrial plants.

15. The overall results of the analyses of the data on Soviet industries indicate that within key economic recovery and military installations, there exists a broad and comprehensive civil defense shelter program. These installations, however, represent only a portion of the entire Soviet economy. This fact should be noted when considering the estimates presented in this report.

## Annex C

### METHODOLOGY FOR ESTIMATING PERCENTAGE OF POPULATION SHELTERED

#### A. Introduction

1. This annex documents a methodology for estimating the percentage of the Soviet urban population<sup>1</sup> that can be sheltered by civil defense personnel shelters. Some of the limitations and restrictions imposed on the estimates by the available data are also discussed.

2. Because of limitations on the survey data, only 15 Soviet cities were used to make projections to the USSR as a whole. The 15 cities and associated survey results are given in table C-1. Under the assumption that the 15 cities are representative of all cities in the USSR with over 100,000 population and that all the shelters actually present at each city have been identified in the surveys, it is estimated that approximately 11 percent of the Soviet urban population could be sheltered by personnel shelters using an occupancy factor<sup>2</sup> of 1 square meter per person. Under the same assumptions, the 95-percent confidence bounds based on this estimate are that the true percentage protected lies between 4 and 17 percent. If a 0.5-square-meter occupancy factor is used, the estimate is 22 percent with 95-percent confidence bounds of 8 and 34 percent.

3. There are, however, several indications that the assumptions underlying these estimates and confidence bounds are not valid. For example, the 15 cities may not be representative of all cities in the USSR with regard to such factors as population, economic considerations, and geographic location. In fact, the 15 cities were not chosen randomly. In addition, the actual number of shelters and, thus, the total shelter area in the 15 cities are most likely larger than the figures given in table C-1 because of new information on basement shelters acquired after some surveys had been finished.

<sup>1</sup> Urban population is defined to be the population living in cities of over 100,000 persons.

<sup>2</sup> Shelter "occupancy factors" are based on figures most often quoted in Soviet publications and by human sources.

4. It is not possible to quantitatively assess the effects of the missing shelters and the unrepresentativeness of the 15 cities on the estimates and confidence bounds obtained. Certainly, one implication of the unidentified shelter problem is that for a fixed occupancy factor the percentage estimate is higher and the confidence bounds are wider than those given if the assumptions stated are correct.

5. The choice of the occupancy factor itself greatly influences the percentage estimates. For example, if the average occupancy factor is closer to 1.5 square meters per person, then the estimated percentage of population sheltered drops to 7 percent.

#### B. Estimates of Percentage of Population Sheltered

6. The objective of this analysis is to estimate the total civil defense shelter capacity of all cities in the Soviet Union with over 100,000 population. The percentage or total number of people sheltered can then be derived using a specified shelter occupancy factor (for example, 0.5 or 1 square meter per person) and the latest Soviet population estimates.

7. The shelter capacity estimates are obtained by scaling up information derived from the 28 regional studies to the population as a whole. However, there are several problems with the data obtained from these studies. For example, only 11 of the 28 surveys provided estimates of the area of the shelters detected.

8. After considering problems such as the above, 15 cities of over 100,000 population were selected from the 28 regional studies as a basis for estimating civil defense shelter capacity for the Soviet Union as a whole. These cities with relevant survey results are listed in table C-1. The cities are listed in the first column in order of decreasing 1976 population figures. The total shelters are the actual number of shelters identified by the surveys. The available shelter area is the interior measurement of the shelters. The available

Table C-1

Shelter Survey Results at 15 Soviet Cities

City	Available Shelter Area (thousand sq m) <sup>1</sup>	1976 Population (thousand)	Percentage of Population Sheltered <sup>2</sup>
Leningrad .....	219.2	4,372	10/5
Kiev .....	540.4	2,013	54/27
Odessa .....	70.0 <sup>3</sup>	1,023	14/7
Gor'kiy .....	113.0	1,305	18/9
Ufa .....	26.8	923	6/3
Riga .....	174.0	805	44/22
Khabarovsk .....	41.6 <sup>4</sup>	513	16/8
Irkutsk .....	21.5	519	8/4
Ulyanovsk .....	30.3	436	14/7
Ulan-Ude .....	30.8 <sup>5</sup>	302	20/10
Komsomol'sk .....	27.3	246	22/11
Naberezhnye Chelny .....	70.1 <sup>6</sup>	225	62/31
Belya Tserkov .....	6.5	137	10/5
Daugavpils .....	5.5	112	10/5
Liepaja .....	21.4	103	42/21
* Total .....	1,398.4	13,035	22/11

<sup>1</sup> We have allocated two-thirds of the total floorspace of shelters for personnel, since we know that roughly a third of the floorspace is taken by life support equipment and supplies.

<sup>2</sup> At 0.5 square meter per person/at 1 square meter per person.

<sup>3</sup> Estimated.

<sup>4</sup> Scaled up estimate for entire city.

shelter area for Khabarovsk, Ulan-Ude, and Naberezhnye Chelny was obtained by scaling up the available area figures given for the fraction of the city surveyed.

9. Odessa is the only city included that did not have an estimate of the available shelter area, since the Odessa regional survey did not include size estimates of the shelters. Thus, the estimate of available shelter area for Odessa was obtained by deriving a relationship between shelter area and numbers of identified shelters. The methodology for this estimate is discussed in section D below. A shelter area estimate for the city of Novosibirsk would also have been included, but it was not possible to obtain shelter counts for city alone as distinct from the given counts for the entire oblast.

10. The last column of table C-1 contains estimates of the percentage of each city's population sheltered. Two estimates are given, one using a 0.5-square-meter-per-person occupancy factor and a 1-square-meter-per-person factor. There is considerable variability in the percentages, ranging from a 3 percent at Ufa to 31 percent at Naberezhnye Chelny (at 1 square meter per person).

11. In order to estimate the percentage of population sheltered for all cities of 100,000 population in the Soviet Union, it is necessary to assume that these 15 cities are representative of all such cities in the

country. For example, such factors as population size, economic distribution of industry (for example, heavy industry versus agriculture) and geographic location may all be important in determining the extent of Soviet civil defense activity at a specific city. This assumption and its implications on the estimates are discussed in section C below.

12. If the 15 cities are indeed representative, then one method for estimating the overall population fraction sheltered is to use the ratio of the total available shelter area at the 15 cities to the total population. This estimate is  $1,398,400 \div 13,035,000 = 0.107$  (at 1 square meter per person). Thus, this approach yields an estimate that 11 percent of the Soviet urban population can now be protected (or 22 percent at 0.5 square meter per person). The 95-percent confidence bounds on this estimate considering sampling error alone is that the actual percentage lies between 4 and 17 percent (at 1 square meter per person). These confidence bounds do not take into consideration such factors as the estimation errors in scaling up available shelter area, estimating the available area, errors in the size estimates of the shelters, unidentified shelters at each of the cities, and any bias due to the unrepresentativeness of the 15 cities. Thus, the real confidence bounds of the estimate may be considerably larger than those given due to sampling

error alone. These problems are discussed further below.

13. An alternative approach to estimating the fraction of population protected allows the assumption of representativeness of the 15 cities to be dropped. However, it does require an additional assumption that the available shelter area for any city be approximately a constant proportion of its population. That is, that the percentage of people sheltered remains constant but the absolute number of people sheltered would vary. Area and population may be each plotted on a logarithmic scale. If the assumption of constant proportionality is correct, the points on this log-log scale should lie approximately on a straight line. The 15 points exhibit an increasing trend, although there is considerable variability. Using the method of least squares, it is possible to test for constant proportionality and to obtain the best fitting curve through the 15 points. As a result of a statistical test, the assumption of constant proportionality cannot be rejected and, hence, there appears to be no evidence that the proportion of the population protected increases with population. The best fitting line corresponds to a constant proportion of 0.13. Thus, using this approach, the estimate of the percentage of population sheltered is 13 percent (at 1 square meter per person). This corresponds very well (within the error of estimation due to sampling error) with the ratio estimate of 11 percent discussed earlier.

### C. Assumptions and Caveats to the Analysis

14. In the previous section, estimates were obtained for the percentage of the total Soviet urban population sheltered by civil defense personnel shelters. In the discussion of the estimates, several assumptions and restrictions concerning the data were discussed. The purpose of this section is to further emphasize the importance and implications of these and other factors that impact on the interpretation and use of the estimates.

#### Representativeness of 15 Cities

15. The validity of statistical estimates such as those given above depends to a large extent on how representative the sample is relative to the population of elements from which the sample was selected. In statistical terms, this means ensuring that the sample is randomly selected. This implies, in the problem under discussion, that each Soviet city with a population greater than 100,000 has a chance (sometimes an equal chance) of being selected for the sample. This cer-

tainly does not appear to be the case with this shelter analysis. The 28 regions selected to be surveyed were not selected randomly from all possible regions, since there was considerable subjective bias in their selection. As discussed earlier, the 15 cities used to derive the estimates were selected nonrandomly and were chosen on the basis of completeness of information. The 15 cities appear to be either in the high or low classes of population size, relative to the population distribution of cities for the whole country. Medium-size cities (500,000 to 1 million) are perhaps underrepresented in the sample.

16. The validity of the point estimate and confidence bounds for the ratio estimate (shelter area to population) depend heavily on the randomness assumption. The agreement of the least squares estimate with the ratio estimate adds credibility to the point estimate given, but without the assumption of randomness, the 95-percent confidence bounds given are not realistic and it is not possible to determine non-trivial bounds on the true percentage.

17. As discussed earlier, the shelter area for four of the 15 cities had to be estimated. Thus, the variability in the final estimates is increased and would further widen the confidence bounds on the true percentages.

#### Measurement of Shelter Area

18. There is error introduced by the inexactness and inconsistency of measuring both the exterior and/or interior of detected shelters. This error will have little effect on the point estimates, if there is no consistent bias either to always overestimate or underestimate shelter area.

[ ]  
19. [ ]

[ ] There still may be undiscovered shelters in the surveyed cities. It is not possible to estimate the extent of this. However, it appears

realistic to conclude that the estimates given above are most likely lower than the true percentages.

#### D. Methodology

21. This section discusses the statistical methodology and includes some of the numerical calculations used in the earlier sections of this report. These include the ratio estimator and the least squares estimator of the percentage of urban population protected.

The ratio estimator is defined as

$$\hat{P} = \frac{\sum_{i=1}^{15} a_i}{\sum_{i=1}^{15} p_i}$$

where  $\hat{P}$  is the estimated fraction of population protected,  $a_i$  is the available shelter area of city  $i$  (from table C-1) and  $p_i$  is the 1976 population of city  $i$ . From table C-1,  $\hat{P}=0.107$  or approximately 11 percent of the population can be protected. The approximate 95-percent confidence bounds on this estimate considering sampling error alone are obtained from W. G. Cochran's book<sup>3</sup> as

$$\hat{P} \pm 1.96 S(\hat{P})$$

where,

$$S(\hat{P})^2 = \frac{1}{15(\bar{p})^2} \left[ \frac{\sum a_i^2 - \hat{P}^2 \sum a_i p_i + (\hat{P})^2 \sum p_i^2}{15-1} \right] = 0.0012$$

Here  $\bar{p} = \frac{1}{n} \sum_{i=1}^{15} p_i$  is the average population.

Thus, the approximate 95-percent confidence bounds are  $0.107 \pm 1.96 \sqrt{0.0012}$  or  $0.107 \pm .068$ . Thus, the bounds are 4 and 17 percent at 1 square meter per person.

22. The least squares estimate of the percentage protected was obtained by fitting the model

$$a_i = \beta_0 p_i \beta_1 + \epsilon_i$$

when  $a_i$  and  $p_i$  are as defined above,  $\beta_0$  and  $\beta_1$  are constants to be estimated, and  $\epsilon_i$  is a random error term (unobservable). If  $\beta_1=1$ , then the model implies that shelter area is a constant percentage of population as measured by the proportion  $\beta_0$ . If  $\beta_1=1$ , then shelter area is not proportional to population, but perhaps to some power of population, for example,  $p_i^2$  or  $p_i^4$ .

<sup>3</sup> Cochran, W. G., *Sampling Techniques*, John Wiley & Sons, N.Y., 1963.

23. The constants  $\beta_0$  and  $\beta_1$  can be estimated by fitting the transformed model

$$\log(a_i) = \log(\beta_0) + \beta_1 \log(p_i) + \epsilon'_i$$

by least squares. That is, using the shelter area and population figures for 14 of the cities in table C-1 (excluding Odessa), the estimates  $\log(\hat{\beta}_0)$  and  $\hat{\beta}_1$  are determined by minimizing the sum of squares

$$\sum_{i=1}^{14} [\log(a_i) - \log(\hat{\beta}_0) - \hat{\beta}_1 \log(p_i)]^2$$

The estimates obtained are:

$$\begin{aligned} \log(\hat{\beta}_0) &= -0.973 \\ \hat{\beta}_1 &= 0.935 \end{aligned}$$

The estimate of  $\beta_1$  is not significantly different from 1. Thus, the best fitting model is:

$$\log(a_i) = -0.873 + \log(p_i)$$

or

$$\begin{aligned} a_i &= 10^{-0.873}(p_i) \\ &= 0.134(p_i) \end{aligned}$$

Thus,  $\hat{\beta}_0=0.134$  and the least squares estimate is that approximately 13 percent of the population can be protected at 1 square meter per person.

24. Table C-1 contains an estimate of the shelter area for Odessa. The estimate of 70,000 square meters falls within the range of three different estimating procedures discussed below. Substituting any other value in this range for 70,000 would not alter any of the conclusions reached in this report. This approach is imprecise, but the range of estimates is not large enough to significantly affect the analyses conducted using Odessa.

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26. Thus, there are three separate estimates of the shelter area at Odessa: 45,747, 54,490, and 76,680 square meters. It is not clear which of these estimates is more appropriate but, as stated above, the estimates of percentage of population protected are not affected significantly by choice of either estimate.

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## Annex D

### EXPLANATORY NOTES FOR INTERACTION ANALYSIS

#### A. Introduction

1. This annex summarizes the assumptions, methodology, and conclusions of the effects of Soviet civil defense measures described in chapter VII. The analytic models used were developed by the Department of Defense and its contractors. They were modified and calibrated by members of the Interagency Working Group for the purpose of estimating population damage from a comprehensive US attack against the Soviet Union. The assumptions in all cases are those of the Interagency Group and not those of the Department of Defense or its contractors.

2. The interaction analysis consisted of three separate parts: the design of a hypothetical US attack; an allocation of US weapons to Soviet targets, tracking predetermined levels of damage; and an assessment of population casualties and fatalities. We deliberately selected an attack that would test the population protection measures of the Soviet civil defense program under conservative assumptions in order to establish boundaries that could then be evaluated for sensitivity of results. We did not attempt to construct our analysis around a "plausible" scenario, or a scenario that matched more or less likely attacks.

#### B. Attack Designs and Assumptions

##### Objectives

3. The fundamental assumption was that the United States would not attack first, but instead would be attacking in retaliation after a Soviet strike. We, therefore, did not assume that US forces would attack Soviet ICBM silos. We did not degrade US attacking forces for possible effects of Soviet strategic defenses. Therefore, attrition of US forces was limited only by probabilities of arrivals for US weapons as used by US planners for current forces. In our analysis we withheld a substantial reserve of weapons.

Finally, the Soviet

population was not specifically targeted. Casualty figures were derived from the effects of weapons detonated on military and economic targets with no regard in the aiming of those weapons for population casualty effects.

##### Weapons Allocation

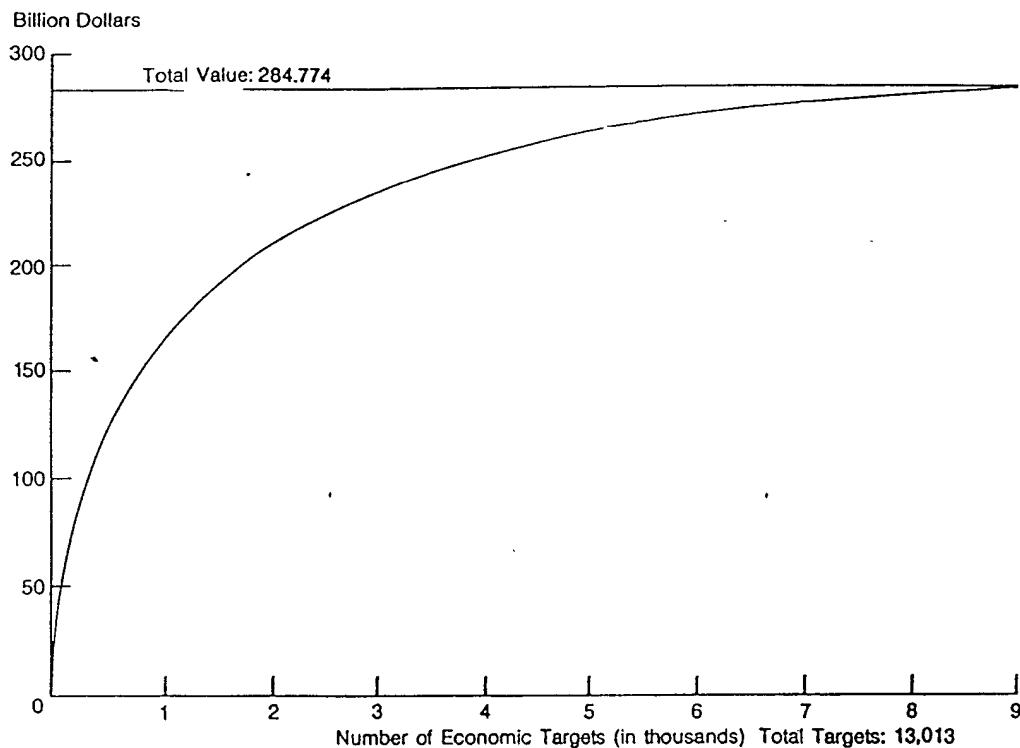
4. The required levels of damage for both military and economic targets was initially set at 90 percent. For military targets the value of a target was assumed to be unity for each installation. A weapon was assumed to have destroyed 100 percent of the target if the damage effects of the weapon covered the target. The value of economic targets used was a combination of replacement cost and the manufacturing value added of an installation's product. However, required levels of damage were applied to the aggregate of installations in the target list rather than to each installation. Thus, some targets were theoretically destroyed entirely while others theoretically could have escaped with little damage so long as the overall level of damage of each industrial category met required levels.

5. After an initial trial of the weapon allocation model, it was determined that an 80-percent damage level for economic value would be more appropriate than the 90 percent originally set. As figure D-1 shows, an 80-percent damage level roughly approximates that point on the damage curve beyond which there is a decreasing marginal return in value destroyed for each target added to the list. The targets were arranged in the list by order of economic importance so that weapons would be allocated against high-value targets first.

6. Owing to the dissimilar value systems used for military and economic targets, for convenience in conducting the analysis we broke down the US retaliatory attack into two waves. The first wave was against military targets; the second against economic targets. The model assessed collateral damage to eco-

## Ordered Distribution of Value for Soviet Economic Targets

Figure D-1



The increase in value of damaged installations begins to diminish beyond the \$228 billion point on this curve. This corresponds to slightly over 2,200 economic targets.

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nomic installations as a result of the military attack as well as damage to military targets as a consequence of the economic attack.

7. Approximately 2,000 weapons were used in the economic attack and 1,700 in the military attack. As table D-1 shows, the weapons assigned to economic targets were all Poseidon C-3s, while those used against military targets were a combination of gravity bombs, SRAMs, and the surviving Minuteman forces. Well over 1,000 weapons were held in reserve. These numbers were determined to be within the limits of those surviving after a hypothetical Soviet counter-force attack against calendar year 1978 US forces on day-to-day alert.

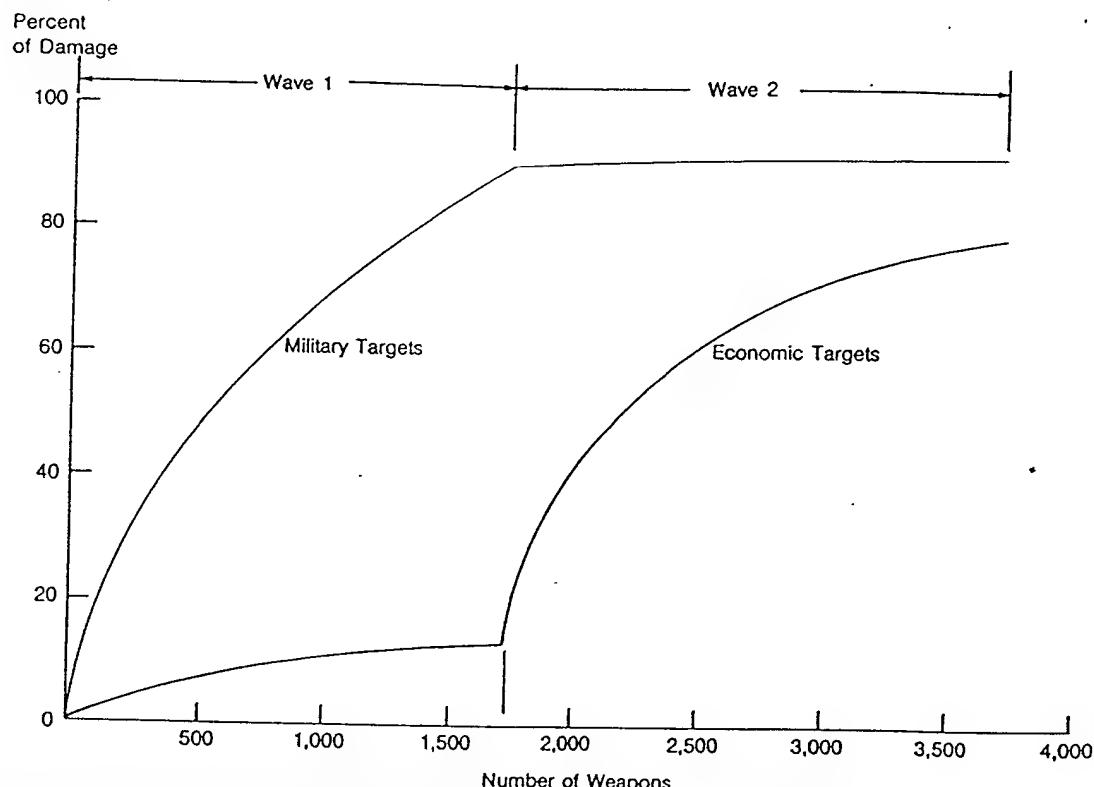
8. A slightly modified NUCWAVE<sup>1</sup> model was used to allocate weapons and assess nonpopulation damage. This model was able to achieve the required level of damage with the focus described in paragraph 5 above. Figures D-2 and D-3 show the damage response curves for various categories of military targets. The most striking features of these curves are the relative ease with which submarine bases were likely to be damaged and the relative difficulty the model had in destroying communication facilities. The "missile" curve refers to intermediate-range and

<sup>1</sup> This model was developed and is maintained by the Office of the Assistant Secretary of Defense, Programs Analysis and Evaluation.

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Comprehensive Attack Damage Response Curves (Percent)

Figure D-2

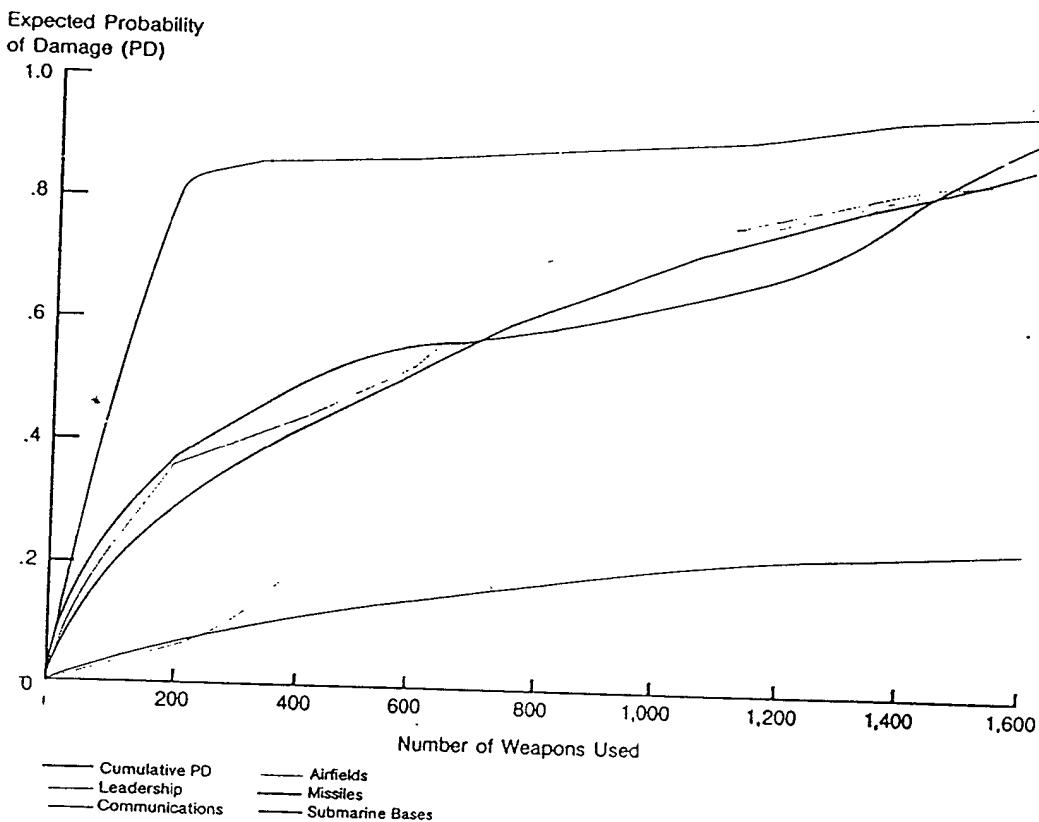


Some damage to economic targets results from the military attack. This has the effect of reducing the total number of weapons required for 80-percent damage in the economic attack to about 2,000.

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## Comprehensive Attack Damage Response Curves (Probability)

Figure D-3



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medium-range missiles targeted or located with other targets. Leadership targets were military command facilities and facilities known to be associated with the Soviet national command authority.

9. The SIDAC<sup>2</sup> model was used to assess population damage. This model assesses damage from blast (overpressure) initial radiation and fallout over 30 days. Levels of protection against all these effects are assumed to remain constant throughout the 30-day period. The SIDAC model was run several times in order to assess the effects of assigning various levels of

hardness and protection factors to urban centers and rural areas.

10. The population evacuated from urban areas was distributed uniformly throughout inhabited rural areas according to the following criteria: no one was to be moved more than 200 miles; no evacuation to uninhabited areas was to take place; and only cities larger than 50,000 population were to be evacuated. When evacuation was modeled, we assumed that 75 percent of the population of the affected cities would be moved, the other 25 percent would remain in shelters. We followed Soviet planning criteria in using a 2-to-1 hosting ratio for the evacuated population. However, that part of the Soviet plans which calls for evacuation

<sup>2</sup>This model was developed and is maintained by the Office of the Assistant Secretary of Defense, Programs Analysis and Evaluation.

along major transportation routes was not followed. Instead, the population was distributed radially outward from a population center to all adjacent cells, so long as those cells were populated before the evacuation was modeled.

11. Damage in urban areas was assumed to be a joint function of the distribution of people around a point according to the "P-95" system of population density, and the overlapping effects of the weapons bursting in that area. The evacuated and rural population was assumed to be located in the geometric center of a cell measuring 20 by 30 minutes on a side. Fallout or blast effects covering the center point generated casualties according to the intensity of effects and the number of people assigned to the point. The distribution of radiation effects across the Soviet Union are shown in figures D-4 and D-5.

12. A composite of March winds for each cell was used for population damage assessment since these

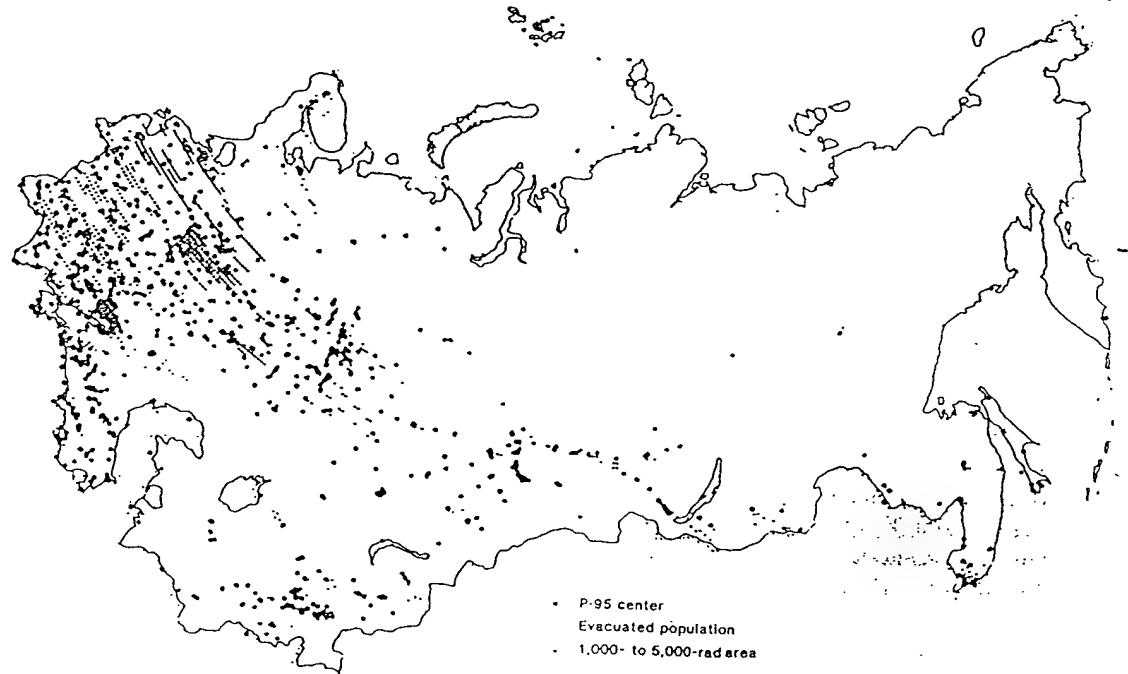
were thought to be most representative in terms of expected casualties and fatalities. The representativeness of these wind patterns was determined by running the SIDAC model for average wind patterns of each month while holding blast protection equal to that provided by a multistory concrete reinforced building and fallout protection equal to 5. Population damage effects as a function of varying wind patterns for every month of the year are shown in figure D-6.

#### Population Damage Assessment

13. A base case and eight excursions were selected for study in assessing fatalities and casualties. The variables were protective factors, hardness of shelter, and whether urban evacuation was assumed to have taken place. Protection factors (PFs) were either 6 or 100, corresponding roughly to the shelter afforded by a freestanding frame building and a deliberate shelter,

Radiation Levels On Evacuated Soviet Population (1,000- to 5,000-rad radiation levels)

Figure D-4



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Radiation Levels On Evacuated Soviet Population (200- to 1,000-rad radiation levels)

Figure D-5



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respectively. The hardness for the rural population was assumed to be equal to that afforded by a multistory concrete reinforced building—an overpressure resistance of 100 kilopascals (14 pounds per square inch) for 50-percent damage. Urban population was assumed to be either 75-percent evacuated or not at all. Hardnesses for the sheltered portion of the population were assumed to be either 350 kPa (50 psi) or 1,030 kPa (150 psi) depending on whether they were assumed to be in deliberate or in expedient shelters. Assignment of the above variables for the nine cases were as shown in table D-2.

14. In estimating casualties and fatalities for different periods of Soviet civil defense preparation, we used four of the nine cases shown in figures D-7 and D-8.

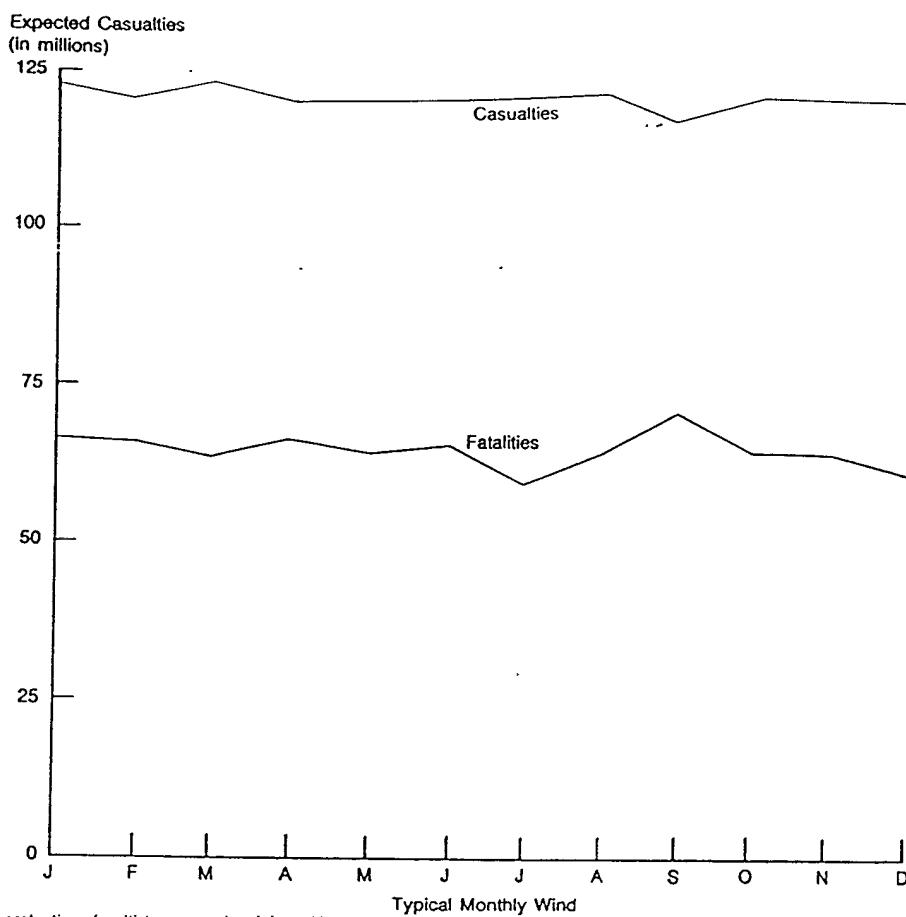
15. The base case was chosen to represent the minimal preparation period. In this case, the overall protection factor assigned is 6, rural population is assigned a hardness of 70 kPa (10 psi), and no evacuation is assumed to have taken place.

16. Case 1 represents the limited preparation period. In this case, 25 percent of the urban population is assumed to have taken shelter in blast shelters which were assumed to be hardened to 690 kPa (100 psi)—an average of the lowest and highest figures that our study of blast shelters revealed.

17. Case 3 represents the moderate preparation period. In this case, 75 percent of the urban population is assumed to be evacuated. In other respects this case is the same as case 1.

## Expected Casualties as a Function of Typical Monthly Winds\*

Figure D-6



\* Assumes a blast protection of multistory concrete reinforced buildings and a protection factor of 5.

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Table D-2  
Case Summaries

Case	Protection Factor	Rural	Population Structure	
			25 Percent Urban	75 Percent Urban
Base	6	MSCRB <sup>1</sup>	MSCRB	MSCRB
1	6	MSCRB	DEL <sup>2</sup>	MSCRB
2	6	MSCRB	DEL	MSCRB (EVAC) <sup>3</sup>
3	100	MSCRB	DEL	MSCRB
4	100	MSCRB	DEL	MSCRB (EVAC)
5	6	MSCRB	EXP <sup>4</sup>	MSCRB
6	6	MSCRB	EXP	MSCRB (EVAC)
7	100	MSCRB	EXP	MSCRB
8	100	MSCRB	EXP	MSCRB (EVAC)

<sup>1</sup> MSCRB refers to multistory concrete reinforced buildings of standard Soviet construction.

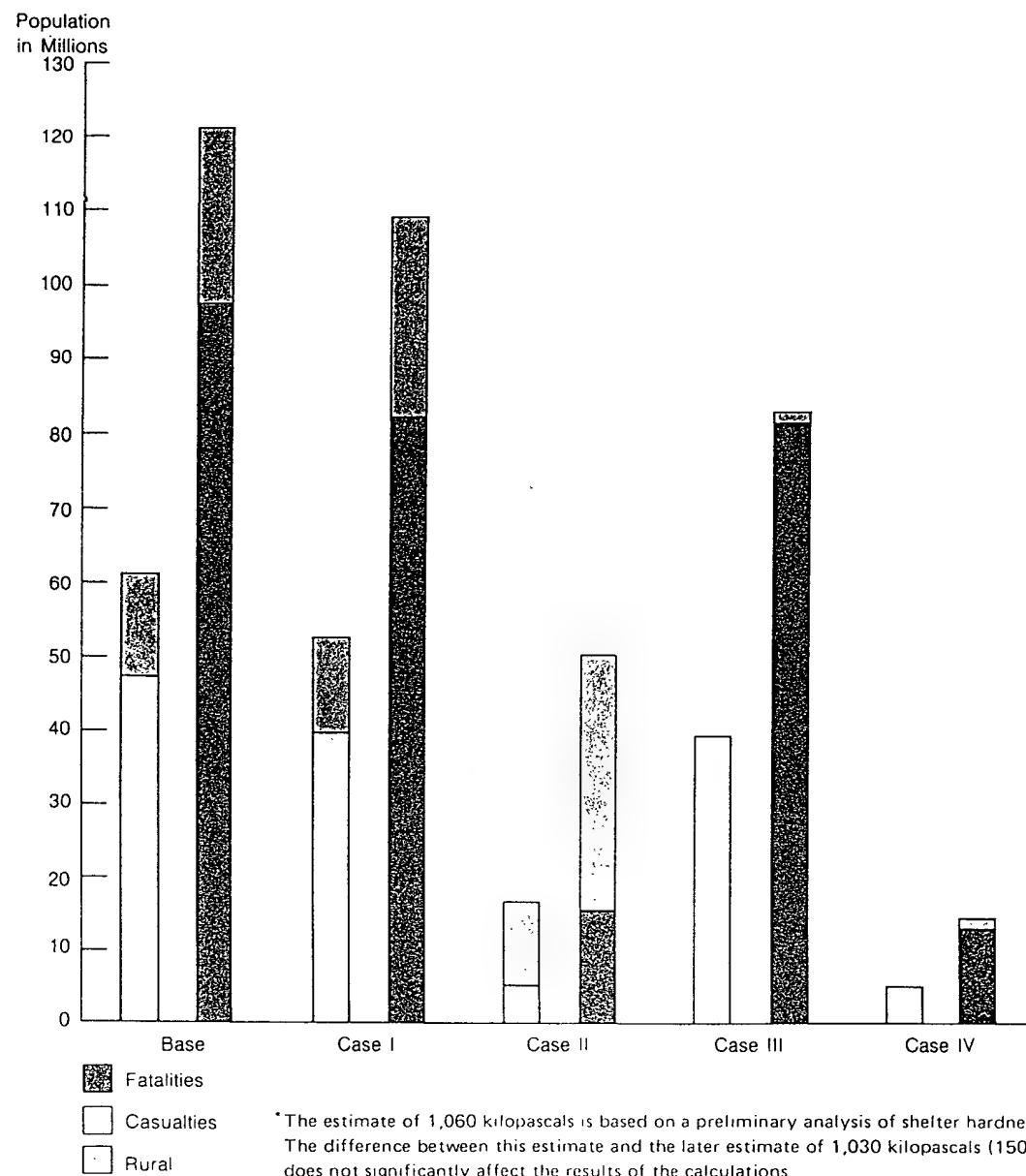
<sup>2</sup> DEL refers to deliberate shelters.

<sup>3</sup> EVAC means that the population was evacuated.

<sup>4</sup> EXP refers to expedient shelters.

## Urban Shelters Evaluated at 1,060 Kilopascals (154 pounds per square inch)\*

Figure D-7

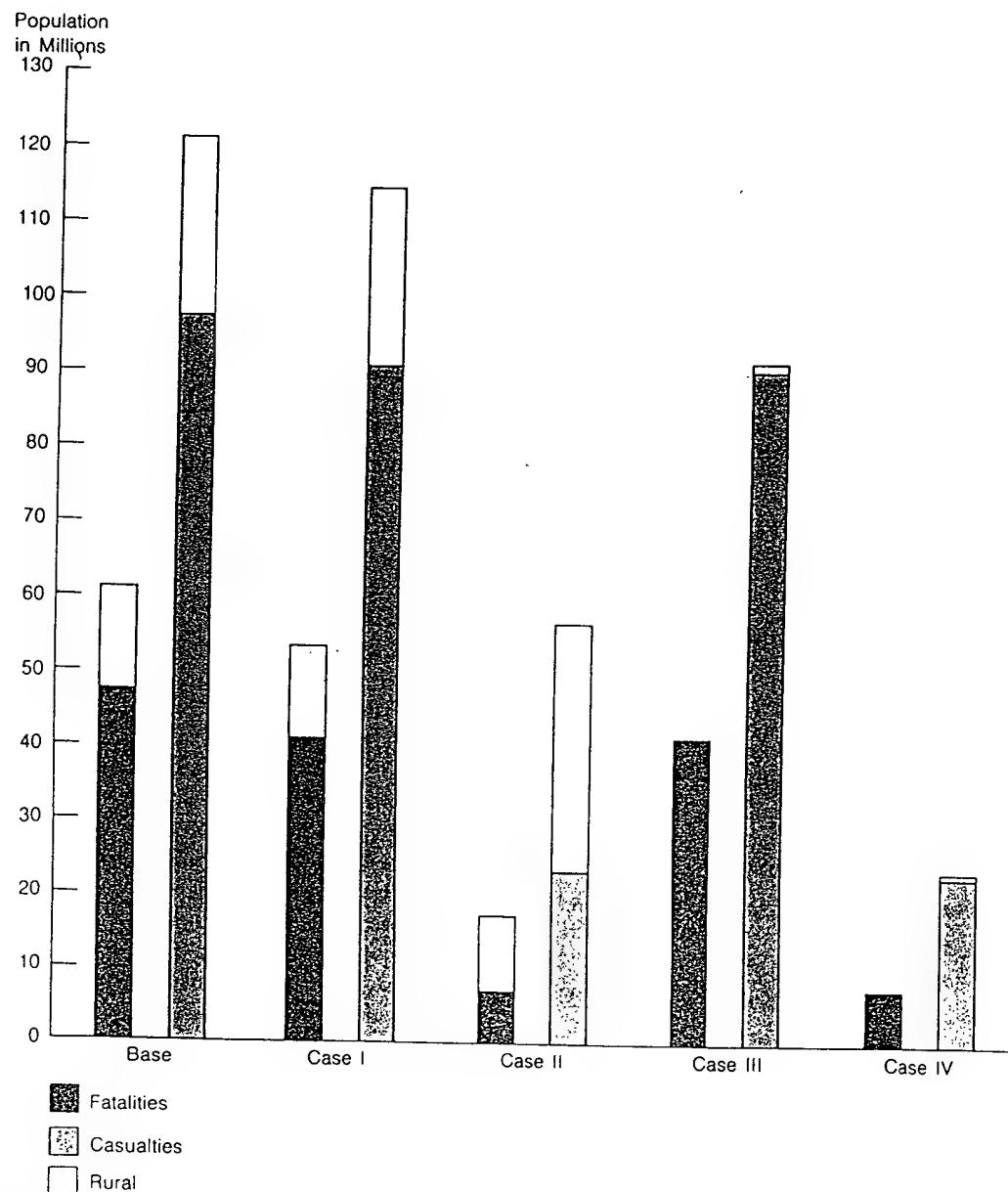
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Urban Shelters Evaluated at 350 Kilopascals (50 pounds per square inch)

Figure D-8



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18. Case 7 represents the extended preparation period. In this case the entire population is assigned a protection factor of 100, the urban population is evacuated as in case 2, and hardnesses for those not in

blast shelters is assumed to be about 70 kPa (10 psi), or equal to the blast protection afforded by the basement of a multistory concrete reinforced building.

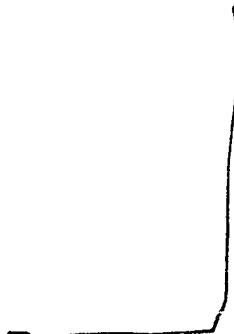
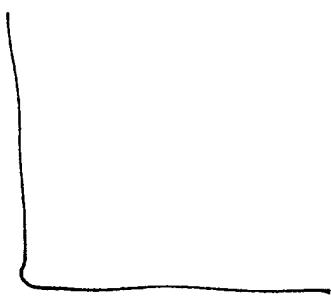
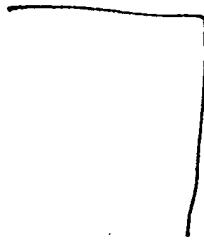
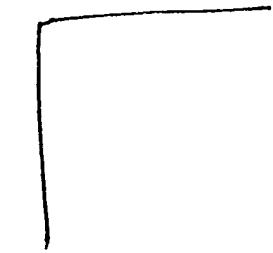
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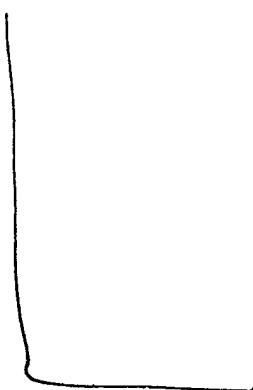
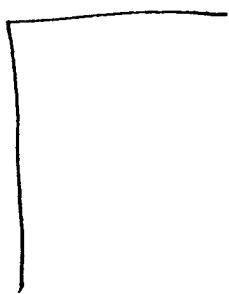
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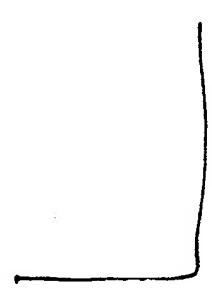
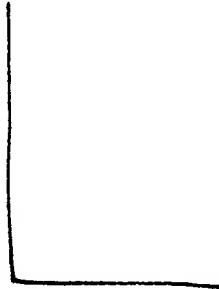
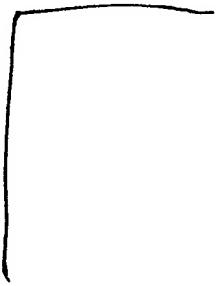


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Annex F

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  - a. Documents published in the USSR during the 10-year period, 1968-77.
  - b. The intrinsic value of each document's contents.
  - c. The coverage of representative subjects within the broad field of civil defense.
2. Not all of the documents included in this bibliography have been translated into English. Significant sources in the Russian language are included so that those readers interested in conducting in-depth research of Soviet disaster preparedness have an appropriate, initial, open-source data base.
3. The following selected books are arranged in chronological order by date of publication, beginning with the oldest:

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